LOCKHEED

F-117 NIGHTHAWK

CUTTING EDGE

● "Stealth" fighter ● Invisible to radar ● Deadly accurate attacker

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it struck the most heavily defended Iraqi targets with stunning effect.

... late ... shape was revealed. And that angled, faceted shape was like no other aircraft.

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● "Stealth" fighter ● Invisible to radar ● Deadly accurate attacker

CUTTING EDGE

▲ *The intense secrecy surrounding Stealth meant that it was not until the late 1980s that the F-117's true shape was revealed. And that angled, faceted shape was like no other aircraft.*

The Lockheed F-117A "Stealth" fighter is one of the most sophisticated warplanes ever built. Almost invisible to radar, the F-117 has revolutionized air warfare. It was operated at first under conditions of total secrecy, but in 1991 the U.S. Air Force deployed it openly to Saudi Arabia for service in the Gulf War. Ranging the night skies over Baghdad with impunity, it struck the most heavily defended Iraqi targets with stunning effect.

PHOTO FILE

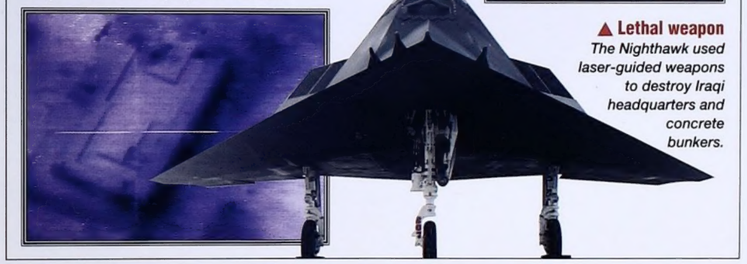
LOCKHEED F-117 NIGHTHAWK

◀ The "Wobblin' Goblin"
Rumors abounded that the handling of the F-117 was somewhat erratic, especially when refueling. As a result, one of the first nicknames for the plane was the "Wobblin' Goblin."

▲ An expensive bird
Only 59 production F-117s were built, yet the total cost of the program is over six billion dollars.

In harm's way ▶
The F-117 was the only Coalition aircraft able to operate with complete freedom over Baghdad's extensive anti-aircraft defenses.

▼ Gulf War spearhead
Forty F-117s were deployed to the Gulf.



▲ Lethal weapon
The Nighthawk used laser-guided weapons to destroy Iraqi headquarters and concrete bunkers.

FACTS AND FIGURES

- **The 40 F-117s deployed to the Gulf flew more than 1,270 missions, dropping 30 percent of all precision-guided munitions.**
- **One B-52 bomber has a larger radar cross-section than all the F-117s put together.**
- **The F-117 was operational for seven years before it made its first public appearance.**
- **The F-117's weapon system can hit a target one yard square.**
- **The first combat use of the F-117 came in Panama on December 21, 1989.**
- **The F-117's radar cross-section is about one one-hundredth of a square yard—about the same as that of a seagull.**

PROFILE

The invisible bomber

The sky over a modern battlefield is a dangerous place. Radar-guided missiles and guns endanger any aircraft flying more than a few inches above the ground. Flying fast and low makes survival more likely, but at the same time makes hitting the target a matter of split-second timing.

In an attempt to counteract the seemingly impossible advantage of the defenders, Lockheed's shadowy "Skunk Works"—the Advanced Development Project Office—was contracted by the U.S. Department of Defense in the late 1970s to produce a low-observable strike fighter. Operational by 1983, the F-117A Stealth fighter is perhaps the most unusual aircraft ever flown.

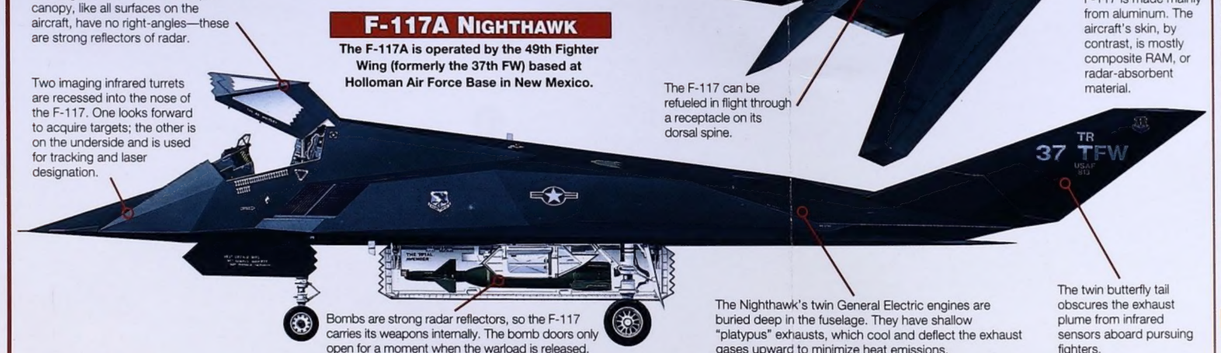
The F-117's unusual shape and the advanced material from which it is manufactured make the Stealth fighter all but invisible to radar. By flying at night, the black jet is also invisible to the eye.

Because it can't be detected, the F-117 can take its time in attack. This makes for remarkably accurate weapons delivery, as was shown to great effect during the Gulf War.

The unique arrow shape of the F-117 is naturally unstable. Stability is maintained by computerized fly-by-wire controls.

F-117A Nighthawk

The F-117A is operated by the 49th Fighter Wing (formerly the 37th FW) based at Holloman Air Force Base in New Mexico.



The edges of the F-117's cockpit canopy, like all surfaces on the aircraft, have no right-angles—these are strong reflectors of radar.

Two imaging infrared turrets are recessed into the nose of the F-117. One looks forward to acquire targets; the other is on the underside and is used for tracking and laser designation.

Bombs are strong radar reflectors, so the F-117 carries its weapons internally. The bomb doors only open for a moment when the warload is released.

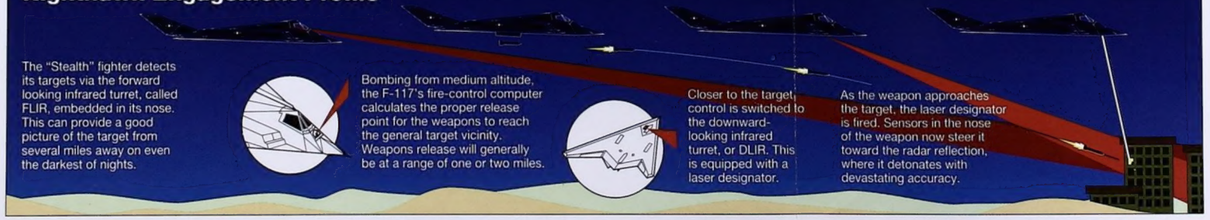
The F-117 can be refueled in flight through a receptacle on its dorsal spine.

The Nighthawk's twin General Electric engines are buried deep in the fuselage. They have shallow "platypus" exhausts, which cool and deflect the exhaust gases upward to minimize heat emissions.

The skeleton of the F-117 is made mainly from aluminum. The aircraft's skin, by contrast, is mostly composite RAM, or radar-absorbent material.

The twin butterfly tail obscures the exhaust plume from infrared sensors aboard pursuing fighters.

Nighthawk Engagement Profile



The "Stealth" fighter detects its targets via the forward looking infrared turret, called FLIR, embedded in its nose. This can provide a good picture of the target from several miles away on even the darkest of nights.

Bombing from medium altitude, the F-117's fire-control computer calculates the proper release point for the weapons to reach the general target vicinity. Weapons release will generally be at a range of one or two miles.

Closer to the target, control is switched to the downward-looking infrared turret, or DLIR. This is equipped with a laser designator.

As the weapon approaches the target, the laser designator is fired. Sensors in the nose of the weapon now steer it toward the radar reflection, where it detonates with devastating accuracy.

SPECIFICATIONS
F-117A Nighthawk

Type: Single-seat low-observable strike fighter.

Powerplant: Two non-afterburning General Electric F404-GE-F1D2 engines, each delivering 10,800 lb.-thrust.

Maximum speed: Mach 1 (estimated).

Combat radius: 750 mi. unrefueled, with 5,000 lb. weapon load.

Service ceiling: Not revealed.

Weapons: Up to 5,500 lb. carried internally. Principle weapons are BLU-109 low-level or GBU10/GBU 27 medium-level laser-guided bombs. Provision for two AIM-9L air-to-air missiles.

Weights: Empty 30,000 lb.; loaded 52,500 lb.

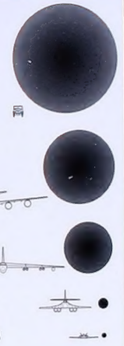
Dimensions:

Span	43 ft. 4 in.
Length	65 ft. 11 in.
Height	12 ft. 5 in.
Wing area (estimated)	913 sq. ft.

ACTION DATA

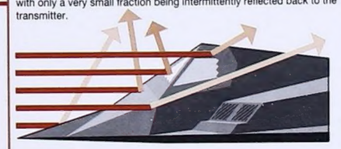
RADAR CROSS-SECTION

Radar cross-section is a measure of how large an object appears to be on a radar screen. Several things affect the cross-section. Right-angles are very good reflectors of energy, hence the immense signal returned by the truck. The fan blades in jet engines also return a significant signal, which is why the Boeing 747, with its huge exposed turbofans, or the B-52G, with its eight engines, generate such large returns. Both of the more modern aircraft show how effectively the radar cross-section can be reduced.



HOW STEALTH WORKS

The Stealth fighter has two main means of defeating enemy radar. The faceted construction deflects most radar energy in multiple directions, with only a very small fraction being intermittently reflected back to the transmitter.



Radar absorbent material (RAM) and composites absorb radar energy, leaving much less to be reflected.

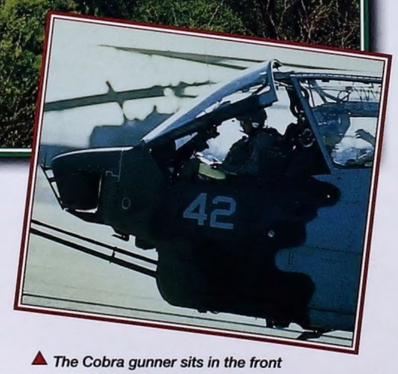
BELL

AH-1 COBRA

● The first "Gunship" ● Close support ● Precision antiarmor

NUMBER 2 GROUP 3

HELICOPTERS AND VERTIPLANES



The Bell AH-1 Cobra is the first true armed helicopter, designed from the skids up as a rotorcraft gunship. Twenty-five years after bringing vertical warfare to Vietnam, the Cobra continues to reach out with lethal guns and missiles, halting the enemy in its tracks. Today the Cobra is flown by Marine pilots who use the AH-1's speed and power to fight and win, no matter what the odds.

▲ *The Cobra gunner sits in the front cockpit. At his disposal is a fearsome array of guns and missiles that can be fired with frightening rapidity.*

PHOTO FILE

BELL AH-1 COBRA

▲ **Minigun**
Early Cobras carried the Minigun, a six-barrel machine gun, which fired at rates of up to 100 rounds per second. Today the slower but harder-hitting M197 20-mm cannon is fitted.

▲ **In the weeds**
Like its serpentine namesake, the Cobra is designed to fight down among the trees and bushes where it can lurk undetected until it is time to rear up and strike.

◀ **Riding shotgun**
As well as taking out enemy tanks, the Cobra is charged with the vital task of escorting assault helicopters. These Army helos are seen on exercise in Egypt.

▼ **Rapid turnaround**
When it is out of missiles, the Cobra can be rearmed in minutes by a well-drilled ground team. The TOW missiles are prepacked in their launch tubes and are strapped straight onto the helicopter.

▲ **TOW launch**
Although some Marine Cobras carry the deadly Hellfire, most AH-1s rely on the TOW missile. As soon as it has been fired out of its tube, small spring-loaded wings and fins pop out of the missile's body, allowing it to fly to its target.

FACTS AND FIGURES

- **The AH-1 first flew on September 7, 1965; new Cobras are being produced today.**
- **Building a Cobra requires 38,500 hours of factory-worker time.**
- **In Operation Desert Storm, four Marine squadrons flew 1,000 missions, including one that destroyed 60 tanks.**
- **The Cobra's stub wing provides some of the lift that keeps it in the air.**
- **Cobra pilots use night vision goggles and electronic sensors to fight in darkness and bad weather.**
- **The AH-1W Whiskey Cobra's cannon fires a depleted uranium shell.**

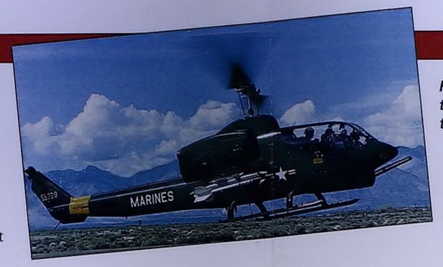
PROFILE

Strike like a snake

The AH-1 Cobra evolved from the famous Bell UH-1 Huey. When the AH-1G model arrived in Vietnam, it became the first rotorcraft designed specifically to carry arms to enter combat. With the helicopter's miraculous ability to leap in and out of tight places, and with a deadly powerhouse of weapons hanging under its stub wings, the Cobra is the infantryman's best friend.

New, hard-hitting Cobras are at work today. The U.S. Army introduced TOW missiles to fight tanks. The Marines went a step further with the laser-guided Hellfire missile, fired from many miles away to kill a tank with pinpoint accuracy.

Today, Marines use the AH-1W "Whiskey Cobra." This warrior in the high-tech battlefield is as formidable in many situations as the Army's newer Apache, which came along years later. The "Whiskey Cobra" excels at amphibious warfare, flying from ship decks or from land. Pilots of this thin, graceful ship praise its nimble flying qualities and its flexibility and fighting prowess.



Helicopter killer—the Cobra can carry the Sidewinder missile on its stub pylons to shoot down other helicopters.

For use against "soft" targets such as troops and trucks, the Cobra carries seven-round rocket pods on the stub pylons.

SPECIFICATIONS
AH-1W "Whiskey Cobra"

Type: Two-seat attack helicopter.

Powerplant: Two General Electric T700-GE-401 turboshafts, each rated at 1,723 shp.

Maximum speed: 219 m.p.h.

Hover ceiling: 14,750 ft.

Range: 365 mi.

Weights: Empty 10,215 lb.; loaded 14,750 lb.

Weapons: One M197 20-mm cannon in undernose turret and four underwing hard points for guided antiarmor, air-to-air missiles, Minigun pods or unguided high explosive rockets.

Dimensions:

Rotor diameter	48 ft.
Fuselage length	45 ft. 6 in.
Height	13 ft. 6 in.
Rotor disc area	1,809 sq. ft.

AH-1W "Whiskey Cobra"

Spearheading the Marine assault is the AH-1W, sweeping ahead of the ground troops to root out enemy armor and artillery before they can do any damage.

The stub pylons provide not only the means to carry a large weapon load but also act as miniature wings, providing valuable extra lift when the Cobra is in forward flight.

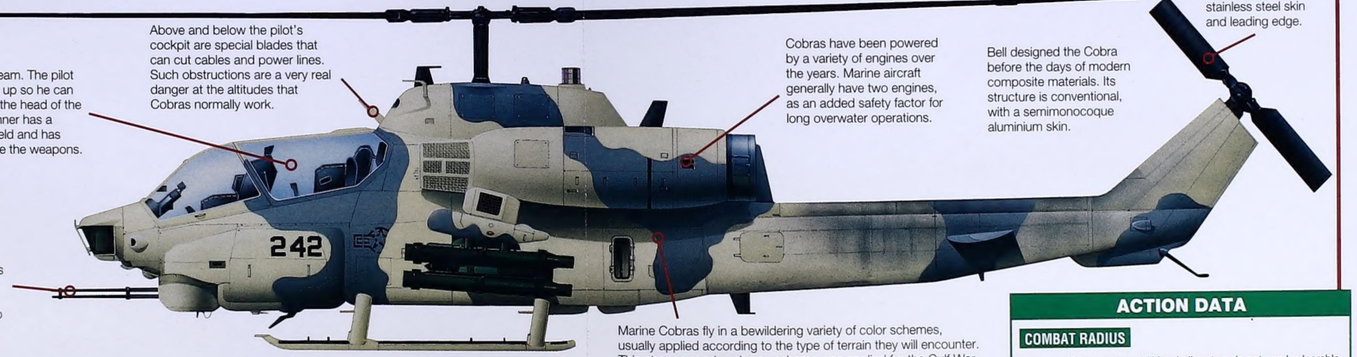
The two-man crew works as a team. The pilot is in the rear cockpit, sitting high up so he can get a good all-around view over the head of the gunner in the front seat. The gunner has a commanding view of the battlefield and has night-vision sights to help him fire the weapons.

Above and below the pilot's cockpit are special blades that can cut cables and power lines. Such obstructions are a very real danger at the altitudes that Cobras normally work.

Cobras have been powered by a variety of engines over the years. Marine aircraft generally have two engines, as an added safety factor for long overwater operations.

Bell designed the Cobra before the days of modern composite materials. Its structure is conventional, with a semimonocoque aluminium skin.

The Cobra's tail rotors are made from an aluminium honeycomb with a stainless steel skin and leading edge.

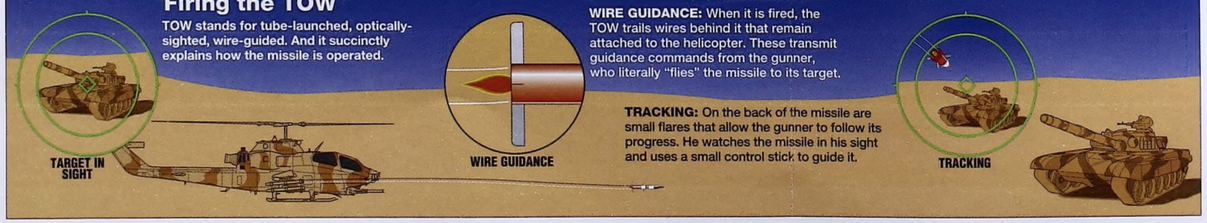


Under the AH-1W's chin is a General Electric turret which houses the deadly 20-mm M197 cannon. This weapon has three barrels and can fire at a rate of 675 rounds per minute, although each burst is limited to just 16 rounds. The turret can swing through 110 degrees either side of the nose.

Marine Cobras fly in a bewildering variety of color schemes, usually applied according to the type of terrain they will encounter. This strange sand-and-gray scheme was applied for the Gulf War.

Firing the TOW

TOW stands for tube-launched, optically-sighted, wire-guided. And it succinctly explains how the missile is operated.



WIRE GUIDANCE: When it is fired, the TOW trails wires behind it that remain attached to the helicopter. These transmit guidance commands from the gunner, who literally "flies" the missile to its target.

TRACKING: On the back of the missile are small flares that allow the gunner to follow its progress. He watches the missile in his sight and uses a small control stick to guide it.

ACTION DATA

COMBAT RADIUS

Because of their unique abilities, helicopters do not need vulnerable fixed bases. Operating from hiding places close to the battle area, they can get into action very quickly, and their lack of range when carrying a full load of fuel, troops and weapons is no handicap.

Aérospatiale/BAC

Concorde

NUMBER 1 GROUP 2 AIRLINERS

● World's fastest airliner ● Mach 2 performance ● Supreme luxury

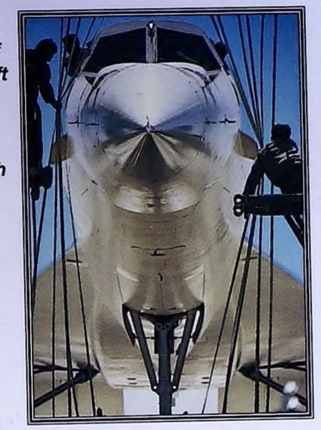
▲ *Although it is a product of 1960s technology without the benefit of multi-screen cockpits and fly-by-wire controls, the Concorde is still the most futuristic airliner to be seen anywhere in the world.*

It is one of the most beautiful aircraft ever built, still capable of turning heads after a quarter of a century. But the Anglo-French Concorde is much more than a work of aeronautic art. A record-breaker from the start, it remains a supremely efficient supersonic aircraft that has proved to be highly profitable on the prestigious air routes between Europe and the United States.

PHOTO FILE

Aérospatiale/BAC Concorde

◀ **Supercruise**
Concorde is one of the very few aircraft able to maintain a supersonic cruise without the use of afterburners, which enables it to fly farther at Mach 2 than any other aircraft.



▲ **Streamlining**
Even at rarified altitudes above 49,000 feet, air friction at twice the speed of sound is a significant factor, so Concorde is polished mirror smooth to reduce drag.

Olympus power ▶
Concorde's engines each pour out more than 18.7 tons of thrust.

▼ **Powerpack**
To gain additional thrust at critical moments such as takeoff and transition to supersonic speed, Concorde's engines are fitted with afterburners.

▲ **Elegant traveling**
Concorde's aesthetically pleasing shape is matched by a standard of service more luxurious than that of any other scheduled airliner.

FACTS AND FIGURES

- **Since Concorde entered scheduled service in 1976, British and French aircraft have carried 3,000,000 supersonic passengers.**
- **Concorde's only rival, the Soviet Tu-144, is no longer in service.**
- **During supersonic flight, Concorde's skin heats to 260° F at the nose.**
- **As fuel is burned off during a flight, Concorde rises an additional 9,850 feet.**
- **Concorde flies 10 miles in the time it takes to fill a passenger's champagne glass.**
- **The 14 Concordes have clocked more supersonic hours than all the fighters used by the world's air forces.**

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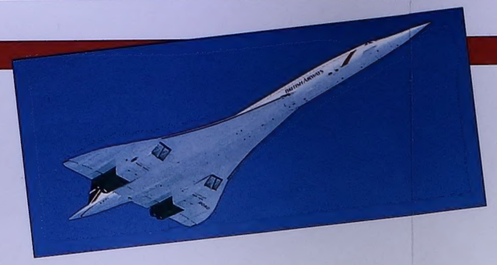
PROFILE

Mach 2 across the Atlantic



Concorde in flight could never be confused with any other aircraft currently in service. The graceful, arrow-like layout, the slender nose and unique, curved double-delta wing are instant recognition features.

Over the last two decades a handful of Concordes have carried more people beyond the speed of sound than all the other supersonic aircraft ever built.

Since its commercial debut in 1976, Concorde has proved deservedly popular. It is the only way a business executive can cross the Atlantic for a meeting and return the same day. A subsonic competitor faces at the very least two six-hour flights and serious jet lag. As a result, Concorde flights are nearly always filled with high-paying passengers.

Yet there is a flip side to Concorde's success. When it entered service the oil crisis had made the viability of a gas-guzzling supersonic jet questionable, and influential American environmentalists were loud in their protests over the noise its powerful engines generated. As a result, options on 70 aircraft by more than a dozen airlines were cancelled.

Nevertheless, the 14 production aircraft delivered to the national carriers in Britain and France have performed splendidly, with higher than average mechanical reliability. They are the world's only operational supersonic airliners and will remain so until well into the 21st century.

SPECIFICATIONS
Concorde

Type: Luxury supersonic airliner.

Powerplant: Four Rolls-Royce/SNECMA Olympus 593 Mk 610 turbojets, each producing 38,030 lb.-thrust with afterburning.

Cruising speed: 1,350 m.p.h. (Mach 2.04) at 49,200 ft.

Range: 3,880 mi. with maximum payload and reserves.

Service ceiling: 60,000 ft.

Payload: Three crew and 100 passengers.

Weights: Empty 173,500 lb; loaded 408,000 lb.

Dimensions:

Span	83 ft. 10 in.
Length	203 ft. 8 in.
Height	37 ft. 5 in.
Wing area	3,856 sq. ft.

ACTION DATA

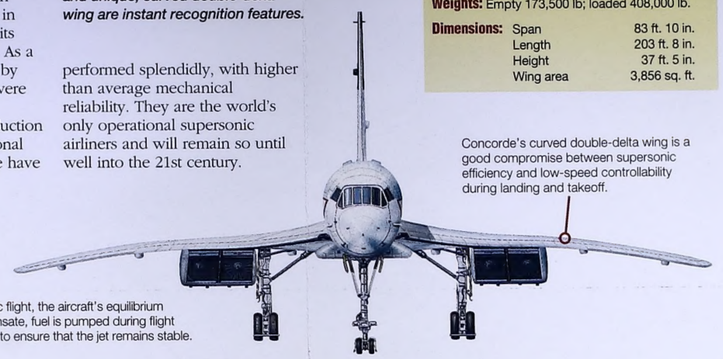
SPEED

MACH 1 = 761 M.P.H. AT SEA LEVEL

Alcock and Brown first crossed the Atlantic nonstop in 1919. Their Vickers Vimy could not exceed 90 m.p.h. Thirty years later, the great piston-engine airliners were crossing in 14 hours. The coming of the jet age increased speed once again. Less than 50 years after that first flight, Concorde has cut the crossing to three and a half hours. But we will have to wait until well into the 21st century to see any advance on that.

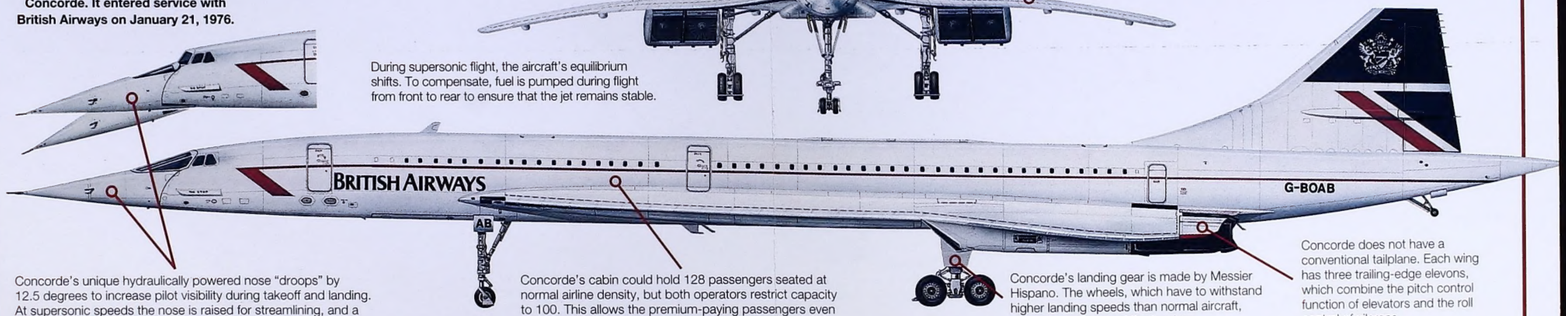
CONCORDE

G-BOAA was the sixth production Concorde. It entered service with British Airways on January 21, 1976.



Concorde's curved double-delta wing is a good compromise between supersonic efficiency and low-speed controllability during landing and takeoff.

During supersonic flight, the aircraft's equilibrium shifts. To compensate, fuel is pumped during flight from front to rear to ensure that the jet remains stable.



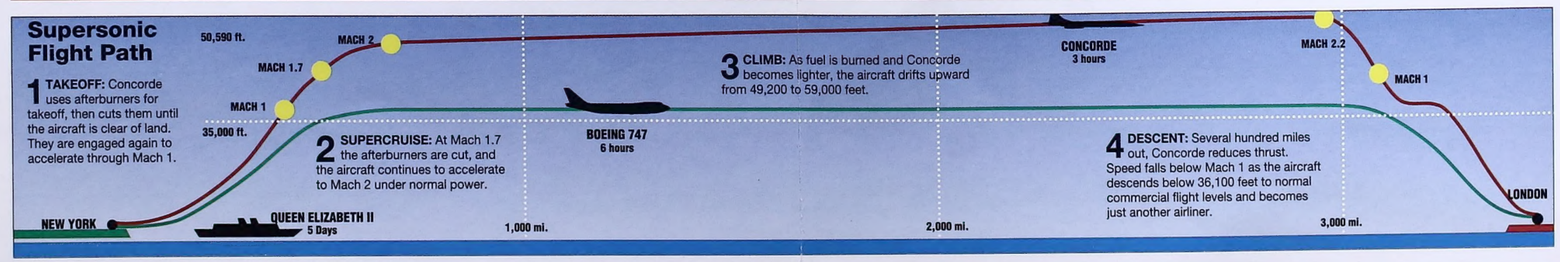
Concorde's unique hydraulically powered nose "droops" by 12.5 degrees to increase pilot visibility during takeoff and landing. At supersonic speeds the nose is raised for streamlining, and a heat-resistant visor protects the cockpit windows.

Concorde's cabin could hold 128 passengers seated at normal airline density, but both operators restrict capacity to 100. This allows the premium-paying passengers even more room than in conventional first-class layout.

Concorde's landing gear is made by Messier Hispano. The wheels, which have to withstand higher landing speeds than normal aircraft, retract inward toward the fuselage.

Concorde does not have a conventional tailplane. Each wing has three trailing-edge elevons, which combine the pitch control function of elevators and the roll control of ailerons.

Supersonic Flight Path



1 TAKEOFF: Concorde uses afterburners for takeoff, then cuts them until the aircraft is clear of land. They are engaged again to accelerate through Mach 1.

2 SUPERCRUISE: At Mach 1.7 the afterburners are cut, and the aircraft continues to accelerate to Mach 2 under normal power.

3 CLIMB: As fuel is burned and Concorde becomes lighter, the aircraft drifts upward from 49,200 to 59,000 feet.

4 DESCENT: Several hundred miles out, Concorde reduces thrust. Speed falls below Mach 1 as the aircraft descends below 36,100 feet to normal commercial flight levels and becomes just another airliner.

BOEING

B-17 FLYING FORTRESS

● Long-range heavy bomber ● Backbone of the U.S. Eighth Air Force

NUMBER 1 GROUP 1

AMERICAN AIRCRAFT OF WORLD WAR II

▲ *The Flying Fortress was America's main strategic weapon in Europe during World War II. From the summer of 1943, huge numbers of Boeing's great silver bird were to be found on English airfields.*

The Boeing B-17 Flying Fortress was one of the most important bombers in history. B-17s fought in every theater of World War II but won immortality in their epic daylight battles against the Luftwaffe. Thousands of young German and American fliers lost their lives, transforming the impotent United States Army Air Force of early 1943 into a force of devastating, destructive power in just 12 months.

PHOTO FILE

BOEING B-17 FLYING FORTRESS

◀ Mass production
Nowhere was America's huge industrial might more visible than in the aircraft factories that turned out hundreds of B-17s each month.

Gun platform ▶
Key to the B-17's design was its heavy machine gun armament, designed to enable the bombers to penetrate defended airspace unescorted.

▼ A hard-fought battle
The Fortress was tough, but over Germany it was pitted against some of the most experienced fighter pilots in the world, and losses were heavy.

◀ The young man's war
It was a rare B-17 pilot who was older than 30. Most of the men who took the big bombers into battle were barely into their 20s.

▲ Silver machines
The B-17 soldiered on after World War II in some oddball roles. This is a rescue aircraft with a lifeboat carried under the fuselage.

FACTS AND FIGURES

- **A B-17 shot down by Japanese Zeroes on the way to Pearl Harbor was the first American combat loss in World War II.**
- **The Boeing 299, the Flying Fortress prototype, first flew on July 28, 1935.**
- **12,731 B-17s were built, with production of the B-17G model by Boeing, Douglas and Lockheed reaching 8,680.**
- **At the height of the war in Europe, B-17s flew from more than 25 airfields in the south and east of England.**
- **More than 47,000 U.S. 8th Air Force crew died in daylight raids over Germany.**
- **An SB-17, a Fortress converted for search and rescue duty, flew the first American sortie of the Korean War.**

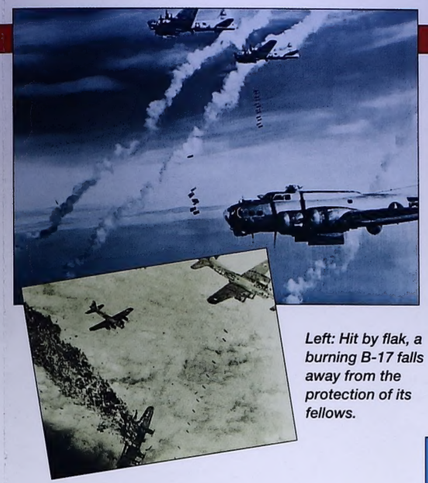
PROFILE

Fortress in the sky

Right: B-17s were used to make precision daylight attacks on German industrial centers.

In the mid-1930s, Boeing engineers suggested a big bomber to the U.S. Army Air Corps. The best American bomber at the time was an inadequate twin-engine adaptation of the DC-3 transport. The decision to go ahead with the B-17 Flying Fortress was a courageous leap forward: it gave the United States an embryonic strategic bomber force by the time the Japanese attacked Pearl Harbor. Early B-17s did not have enough guns and were not available in sufficient numbers, but as the war progressed the Flying Fortresses took command of the skies.

B-17 crews faced many unspeakable horrors, pressing ahead into Luftwaffe fighters and flak while blinded by smoke, slammed by turbulence, plagued with mechanical mishaps, and paralyzed by the numbing cold. On the first Berlin mission, B-17 crewmen killed in the air numbered the same as Germans killed on the ground by bombs (about 400). As the bombing campaign wore on casualties aboard the B-17s remained high, but the bombing became more effective.



Left: Hit by flak, a burning B-17 falls away from the protection of its fellows.

SPECIFICATIONS B-17G

Type: Nine/10-seat long-range bomber.

Powerplant: Four 1,200-hp. Wright R-1820-97 Cyclone turbocharged radial piston engines.

Maximum speed: 290 m.p.h. at 25,000 ft.

Ceiling: 35,600 ft.

Range: 2,000 mi. with 5,000-lb. bomb load.

Weights: Empty 37,300 lb.; loaded 65,500 lb.

Weapons: 13 .50 cal. machine guns in twin turrets, plus single dorsal and fore and aft beam positions; 17,600-lb. max bomb load.

Dimensions:

Span	103 ft. 9 in.
Length	79 ft. 9 in.
Height	19 ft. 1 in.
Wing area	1,420 sq. ft.

The "Mighty Eighth" Air Force was the premier user of the B-17 Flying Fortress.

B-17F "Fast Woman"

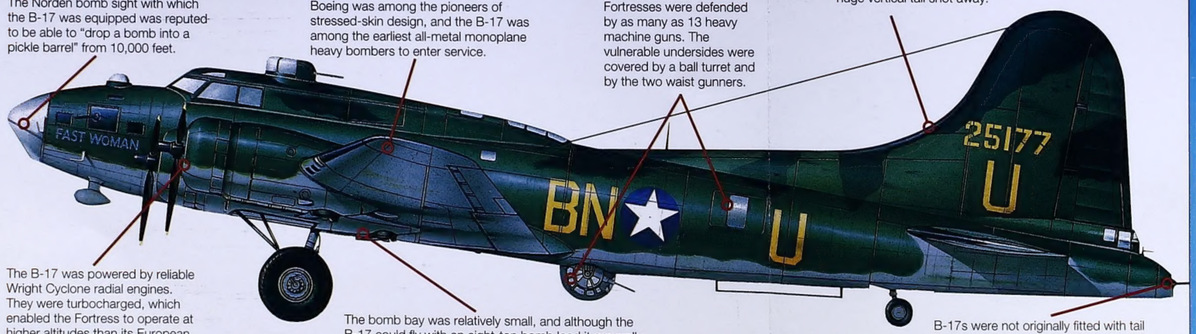
"Fast Woman" was one of the first American B-17s to arrive in Britain during World War II. Attached to the 359th Bomb Squadron of the 303rd Bomb Group, it was based at Molesworth in Huntingdonshire.

The Norden bomb sight with which the B-17 was equipped was reputed to be able to "drop a bomb into a pickle barrel" from 10,000 feet.

Boeing was among the pioneers of stressed-skin design, and the B-17 was among the earliest all-metal monoplane heavy bombers to enter service.

Fortresses were defended by as many as 13 heavy machine guns. The vulnerable undersides were covered by a ball turret and by the two waist gunners.

The B-17 was immensely strong. Aircraft managed to return to base with severe battle damage, and the big bomber could still fly even with large sections of the huge vertical tail shot away.



The B-17 was powered by reliable Wright Cyclone radial engines. They were turbocharged, which enabled the Fortress to operate at higher altitudes than its European contemporaries.

The bomb bay was relatively small, and although the B-17 could fly with an eight-ton bomb load it generally carried a quarter of that amount on operations.

B-17s were not originally fitted with tail guns. A tail gunner's position was added to the B-17E and all subsequent models.

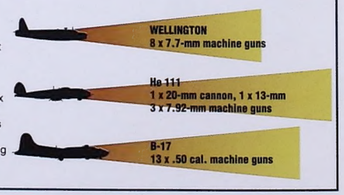
ACTION DATA

RANGE

Designed at a time when other air forces still thought twin-engine machines were heavy bombers, the B-17 carried more bombs over much greater distances than its contemporaries.

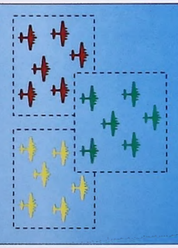
DEFENSES

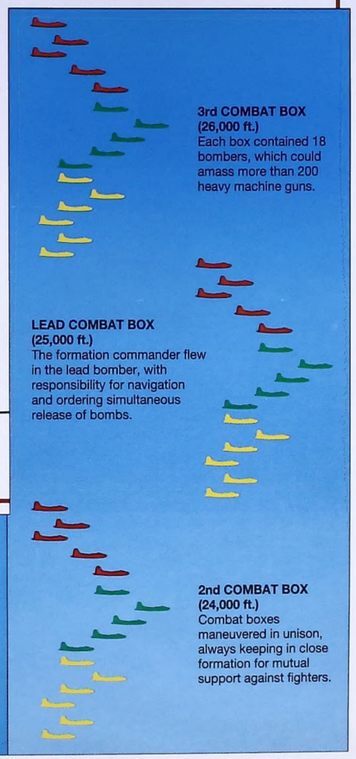
Originally relatively lightly armed, the B-17 entered combat in armor plate and with all-around machine-gun emplacements. A box of just 18 bombers could bring hundreds of guns to bear on an attacker coming from any direction.



Layered defenses

Every B-17 aircraft contributed to the defense of the entire formation. Each squadron of six aircraft moved in unison in formations called boxes, and squadrons were layered and staggered horizontally and vertically, to allow the simultaneous release of bombs.



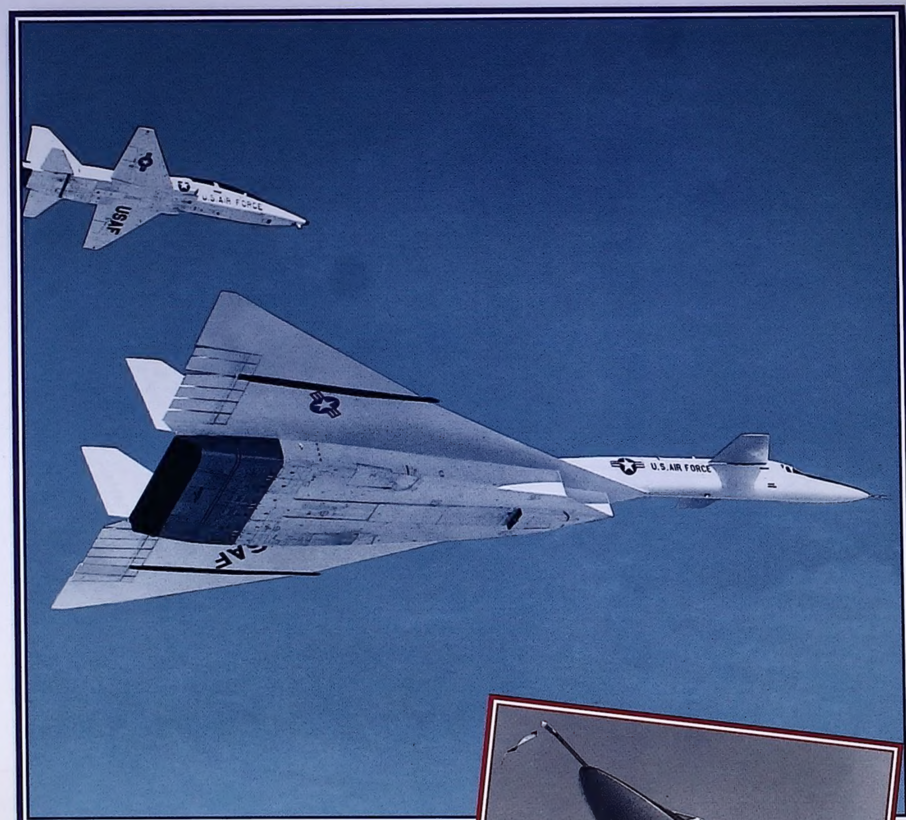


North American

XB-70 Valkyrie

NUMBER 16 · GROUP 16 · X-PLANES

● Mach 3 strategic weapon system ● Fastest bomber ever flown

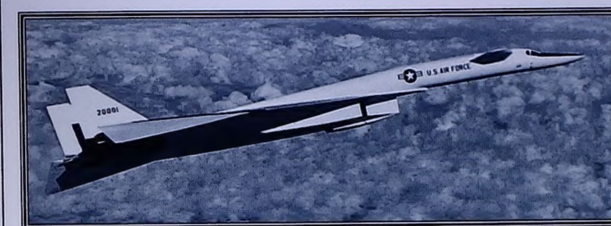


Flying at three times the speed of sound at a 15-mile altitude to deliver a nuclear attack was the role of the XB-70 Valkyrie. This massive delta with six enormous engines would have been uncatchable, and it worried Soviet generals. But the cost of the project spiralled, and problems culminated in a disastrous crash during flight trials. And then surface-to-air missile developments made the XB-70 obsolete at a stroke.

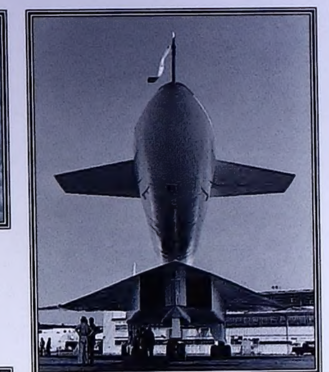
▲ *The XB-70 was the ultimate high-altitude bomber, with a performance that has never been matched. But it was a dead end; the future of the bomber lay in stealthiness and low-level penetration.*

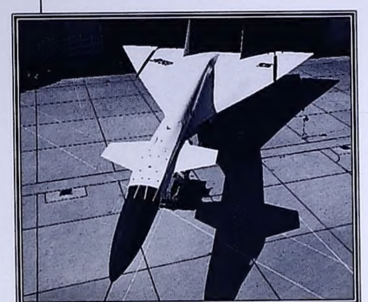
PHOTO FILE

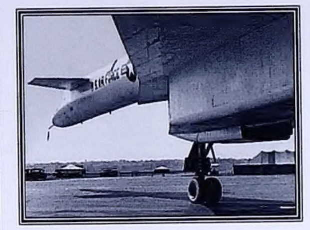
North American XB-70 Valkyrie



▲ Vortex death trap
No one knows why F-104 chase pilot Joe Walker collided with the XB-70, but it is thought the crash was caused by the F-104 getting caught in the huge tip vortices generated by the large delta wings.

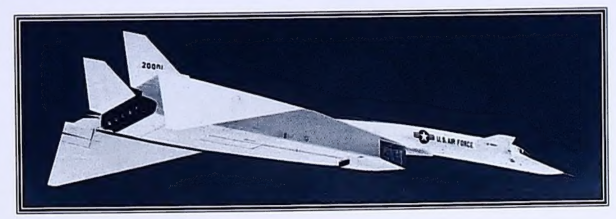






◀ Canard nose ▲
A combination of the large canard foreplanes and trailing-edge elevons controlled pitch. The four-man crew sat in a special ejection capsule, which was the only way to survive an ejection at the heights the Valkyrie flew.

▲ Giant delta
Like the YF-12A and the MiG-25, the XB-70 needed a very thin delta wing with large twin tailfins for stability in Mach 3 flight.



▲ Jet blast
Stealth was the last thing the XB-70's designers had in mind. Both its radar and infrared signatures were immense.

◀ On display
The surviving Valkyrie made its last flight in February 1969 to the USAF museum, where it remains on display to this day.

FACTS AND FIGURES

- The Valkyrie was used for "sonic boom" trials flights in support of the aborted U.S. Supersonic Transport (SST) project.
- During one test flight the XB-70 covered almost 1,000 miles in 33 minutes.
- Ethyl borane was planned to fuel the XB-70, but was found to be too expensive.
- Colonel Joe Cotton described flying the XB-70 as "like driving a Greyhound bus around the racetrack at Indianapolis."
- The project had cost $500 million by the time the XB-70 crashed.
- The folding wingtips were designed to use aerodynamic "shock wave" effects.

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PROFILE

North American's Mach 3 Valkyrie

The Valkyrie was a stunning piece of engineering, but the cost of the Vietnam War made it hard to justify spending more money on it.

Even today, no aircraft can match the staggering performance of the XB-70 Valkyrie. The aim of the aircraft was to fly so fast and high that interception was impossible and nuclear strikes on the Soviet Union could be threatened. In order to evade the latest Mach 2 Soviet fighters, North American designed the huge bomber to cruise at Mach 3 for long distances at extreme altitude. The result was a six-engine delta that burned special fuel, and had wingtips that folded in flight. The machine had to be built from special materials to cope with the heat stress of high-speed flight. The prototype first flew in 1964, and a second aircraft began trials the following year. At first all went well, and the XB-70 demonstrated that it could do everything promised by the makers, including flying at around 2,000 m.p.h.

Tragedy struck during a test flight in June 1966. A Lockheed F-104 Starfighter in formation with the XB-70 for a photo shoot accidentally crashed into the Valkyrie, and both aircraft were destroyed. Only one of the Valkyrie crew ejected.

There was a political storm about the incident and the Valkyrie was cancelled, partly because new Soviet air defense missiles had, by the mid-1960s, made high-level bombers a thing of the past.

XB-70 Valkyrie

Two prototype XB-70 Valkyrie bombers were produced, flying between September 1964 and February 1969. Number 62-207 was destroyed, and 62-001 is now an exhibit at the USAF museum.

The delta wing, which contained large fuel tanks, was designed to create a shock wave that the aircraft could "ride" on, giving vastly increased lift.

To resist kinetic heating, the fuselage and wing structure were built almost entirely from stainless steel and titanium.

The canards were essential for control of the XB-70 at low speed, as the elevons would have been masked by the wing at high angles of attack.

The six massive turbojets would have made the Valkyrie the most powerful aircraft ever built, and probably also the noisiest.

The cockpit afforded limited visibility to the crew, but there was little to see at the XB-70's cruising altitudes anyway.

A large black anti-glare panel was painted in front of the cockpit. The overall paint scheme was a nuclear blast reflective white, which did not stand up well to Mach 3 kinetic heating.

Operational B-70s would have had a four-man crew, consisting of two pilots and two systems operators, all housed in the cockpit escape capsule.

The intake design was all-important, since control of the shock waves it produced affected thrust a great deal. The massive intake box had a huge radar signature.

A long central weapons bay between the intake ducts could carry up to 14 free-fall thermonuclear weapons. There were no defensive weapons; the survival of the Valkyrie depended on high speed and advanced electronics.

Like the wings, the fins had fixed and moving sections. The leading edge was fixed and the rear section could move slightly.

The variable-position wingtips could be set at 25 degrees, or 65 degrees for high-speed flight.

The Valkyrie's fatal crash was caused by one of the other aircraft being photographed with it, an F-104, striking the right fin and ripping most of it off. It then hit the left fin before finally smashing down on top of the left wing and exploding. The Valkyrie flew straight and level for several seconds before spinning to destruction.

SPECIFICATIONS
XB-70A Valkyrie

Type: Prototype supersonic strategic bomber.

Powerplant: Six 31,000-lb.-thrust General Electric YN93-GE-3 afterburning turbojets.

Maximum speed: 2,000 m.p.h. or Mach 3; test aircraft reached 2,019 m.p.h. or Mach 3.08.

Range: 7,600 mi. unrefueled.

Service ceiling: Test aircraft reached 73,980 ft.; planned operational ceiling 82,000 ft.

Weapons: No defensive armament; planned bomb load 50,000 lbs. of free-fall nuclear bombs or of conventional weapons.

Weight: 551,150 lbs. max takeoff.

Dimensions:

Span	105 ft.
Length	196 ft.
Height	30 ft.
Wing area	6,297 sq. ft.

Last ride of the Valkyrie: June 8, 1966

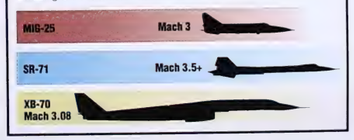
PUBLICITY SHOT: Five aircraft powered by General Electric engines were flying in formation for a publicity shot when a NASA F-104, piloted by Joe Walker, strayed too close to the massive vortex generated by the Valkyrie's downturned wingtip, sucking it in.

TRAGEDY: The tiny F-104 was hurled across the XB-70's wing, smashing one tailfin and then exploding. The Valkyrie flew on for several seconds before tumbling out of control and crashing into the Mojave desert miles below.

ACTION DATA

SPEED

The XB-70 was one of only three aircraft designed to reach Mach 3 operationally. The Soviet MiG-25 was designed primarily to intercept the massive American bomber, although it could not sustain its high speeds for nearly as long as the Valkyrie. Only the amazing SR-71, which was a smaller aircraft, could fly faster.



North American

P-51D Mustang

● Long-range escort fighter ● Most Allied kills ● 281 Mustang aces

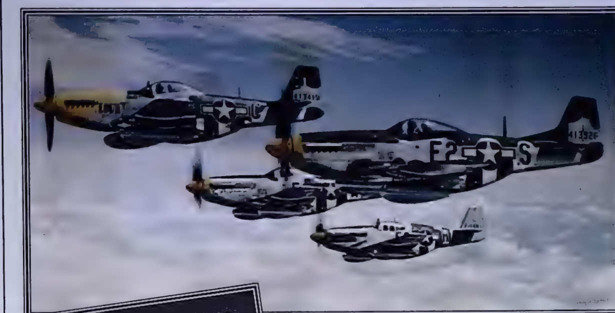
AMERICAN AIRCRAFT OF WORLD WAR II

▲ *One of the great Mustang heroes, Major Don Gentile, with his favorite machine "Shangri-La" during 1943. He made 15 kills in Mustangs—half of them in one month.*

As the bombers of the Eighth Air Force fought their way deep into Hitler's heartland, it was the Mustang that cleared the skies of Luftwaffe fighters. No other combat airplane of the war could fly as high, go as far and fight as hard as the mighty Mustang. In the skilled hands of young U.S. Air Corps pilots, it took on all comers and accounted for more kills than any other Allied airplane.

PHOTO FILE

North American P-51D Mustang



◀ All the way
With underwing tanks, Mustangs had enough range to be able to escort their charges 1,700 miles to the target. When they got there, they were agile enough to beat all comers.

▼ High flyer
The Mustang's phenomenal range and performance made it ideal for escorting high-flying B-29s across the vast Pacific.

◀ Mud movers
The Mustang's hard-hitting and accurate guns made it an excellent ground attack aircraft, that could also deliver air-to-ground rockets or bombs.

Powerpack ▶
The early Mustang was transformed into a superb high-level fighter by the British-designed, Packard-built Rolls-Royce Merlin engine, which could deliver 1,510 horsepower.

▼ Flying veterans
The Mustang's impeccable handling characteristics, bubble canopy and performance make it a popular rich man's toy—and many of them are still flying today. This example even carries a passenger.

FACTS AND FIGURES

- **Ordered by the British, the prototype Mustang was proposed, designed, built and flown in an incredible 117 days.**
- **That initial aircraft was the first of 15,686 examples of the P-51 produced.**
- **The Mustang was flown by 11 Allied air forces in addition to the U.S. Air Corps.**
- **281 Allied Mustang pilots qualified as "Aces," with five or more kills.**
- **The late-model P-51H was, at 472 m.p.h., one of the fastest piston-engine fighters.**
- **In October 1944, Mustang pilot Lieutenant Urban L. Drew managed the astonishing feat of shooting down two Me 262 jets.**

PROFILE

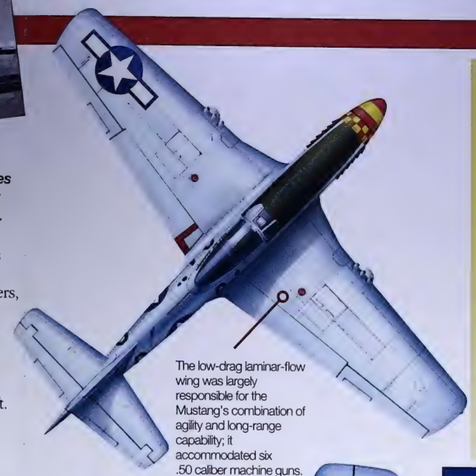
Top Gun to the bomber force

Faced with invasion in 1939 and desperately short of fighters, the Royal Air Force asked North American Aviation to quickly produce the existing but obsolete P-40 Warhawk. Instead, the company designed, built and flew a new airplane in just 117 days—the Mustang.

Using an existing Allison engine and the latest laminar-flow wing, the new fighter immediately went into service with the RAF. In December 1941 the United States joined the war, and it too needed good fighters fast. So the U.S. Air Corps took the basic RAF Mustang, rearmed it with four machine guns, and added an uprated engine. It was a good performer, but couldn't operate well alongside the high-flying long-range bomber.

By 1944 the aircraft used the Rolls-Royce Merlin engine, adopted a new bubble cockpit and increased its firepower to six .50 caliber machine guns. It was now the best fighter in the war and fought superbly in all theaters, as fighter, fighter-bomber and reconnaissance platform. It was loved by its aircrews, and no fewer than 281 Mustang pilots became aces—each shooting down at least five enemy aircraft.

Mustangs were flown by more aces than any other Allied fighter. Their prey even included the Me 262 jet.



The low-drag laminar-flow wing was largely responsible for the Mustang's combination of agility and long-range capability; it accommodated six .50 caliber machine guns.

SPECIFICATIONS
P-51D Mustang

Type: Single-seat long-range escort fighter, fighter-bomber.

Powerplant: One 1,510-hp. Packard V-1650-7 (U.S.-built Rolls-Royce Merlin 61) inverted-vee 12-cylinder inline water-cooled piston engine.

Maximum speed: 445 m.p.h. at 25,000 ft.

Combat radius: 325 miles on internal fuel; 750 miles with two 130-gal. tanks.

Service ceiling: 41,900 ft.

Weapons: Six .50 cal. Browning machine guns in wings; two 500-lb. bombs or eight 75-mm rockets in place of long-range drop tanks.

Weights: Empty 7,125 lb.; Loaded 11,600 lb.

Dimensions:

Span	37 ft.
Length	32 ft. 3 in.
Height	12 ft. 2 in.
Wing area	235 sq. ft.

P-51K Mustang "Nooky Booky IV"

This P-51K was flown by Major Leonard "Kit" Carson (left) of the 362nd Fighter Squadron, based at Leiston, England, as part of the 357th Fighter Group during 1944. Carson was one of the top-scoring Mustang aces, with 18 air-to-air victories.

The bubble canopy and cut-down rear fuselage of the P-51D gave the pilot an unsurpassed all-round view.

The P-51 was transformed by incorporation of the Merlin engine. The original Allison engine delivered plenty of power low down, but was disappointing at higher altitude.

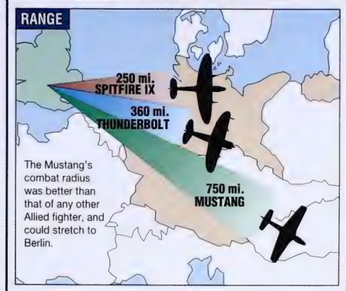
Even without optional underwing external fuel tanks, the Mustang had a good radius of action: with external tanks fitted it could escort bombers all the way to Berlin. These tanks could be jettisoned if the Mustang had to engage in maneuvering combat.

Despite having an in-line, liquid-cooled engine and a prominent and vulnerable ventral (underfuselage) radiator, the P-51D was remarkably tolerant of battle damage.

Initially painted with olive drab camouflaged top surfaces, paint was soon stripped off to save weight, and the bare skin was highly polished to reduce drag.

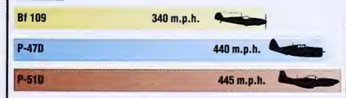
ACTION DATA

RANGE



The Mustang's combat radius was better than that of any other Allied fighter, and could stretch to Berlin.

SPEED



The P-51D's clean, low-drag airframe and powerful Merlin engine endowed it with superb performance.

WEAPONS

The P-51D packed a powerful punch, its fast-firing .50 cal. machine guns proving deadly against enemy fighter targets, although they lacked the stopping power of a 20- or 30-mm cannon.

Mustang, the all-the-way escort fighter

THE BOMBERS: Eighth Air Corps bombers left their British bases an hour ahead of the Mustangs, escorted in the first part of the mission by shorter-ranged P-38s and P-47s.

HAND OVER: The faster Mustangs would catch the formation over the Dutch/German border, where they would relieve the P-38s and Thunderbolts high above the B-17s.

ESCORT: Some fighters flew close escort. Their nearness boosted the morale of the bomber crews, who had been so severely mauled over Germany the year before.

DOGFIGHTER: The Mustang had more than long range. It was fast and it was a ferocious dogfighter, as the pilot of this Messerschmitt Bf 109G shot down by a P-51 discovered.

CONTROL OF THE SKIES: It was the appearance of swarms of these graceful fighters in the skies over Germany that was to signal the death knell of the Luftwaffe.

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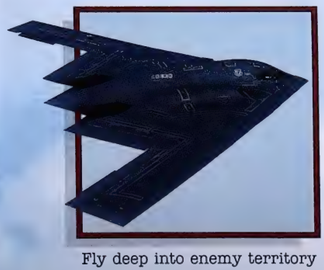

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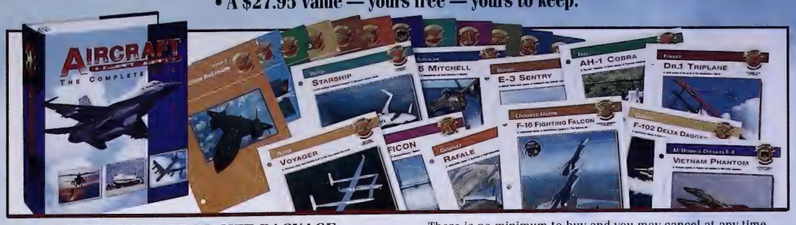

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Sincerely,

Jack Douglas

Jack Douglas

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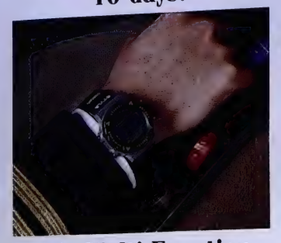

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DIGITAL WATCH

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Do you really want to pass up your Free Gift Package?

Perhaps I have not made the offer clear, and you think there's a catch somewhere.

I give you my word, there isn't.

You don't have to buy anything. You won't be contacted by annoying sales-people. You are under no obligation of any kind.

Perhaps you are suspicious because we are offering such a valuable gift. Please allow me to explain.

You see, it's worth the expense for us just to show you Aircraft Of The World. We've found that once people see how magnificent and exciting the Aircraft cards are, they want to send for more.

But they don't have to! And, neither do you.

If you want to cancel, all you do is write to us at the address printed above.

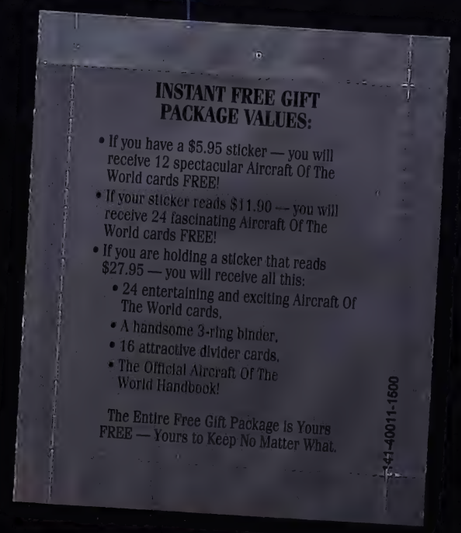
This Free Gift Package is yours to keep no matter what. You can even pass it on to a friend as a gift if you wish.

No strings. No problems. No reason to pass it up. So why not claim the Free Gift Package that is rightfully yours today!

Sincerely,

Jim Garrett

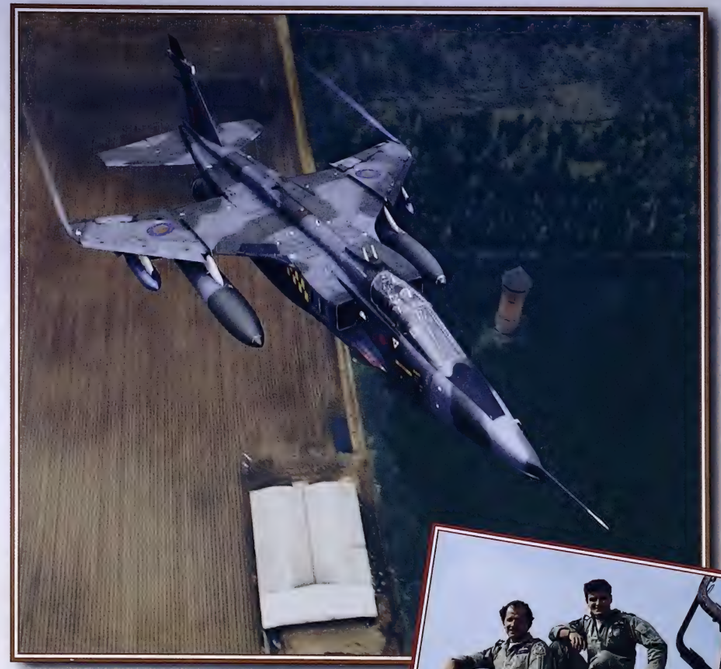
Jim Garrett
Marketing Director



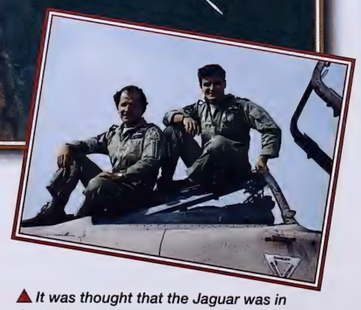
NUMBER 25 GROUP
MODERN COMBAT AIRCRAFT

JAGUAR GR.MK 1/GR.MK 1B

● Anglo-French single-seat attack aircraft ● Gulf War veteran



One of the early successes of Anglo-French collaboration, the Jaguar fighter-bomber has also been the mainstay of the RAF's first-line squadrons over the last three decades. With improved weapons and avionics, it has developed into a useful tactical ground-attack and reconnaissance aircraft, despite its performance being somewhat modest compared with some of its contemporaries.



▲ *It was thought that the Jaguar was in the twilight of its career when both French and RAF Jaguars were sent to the Gulf to participate in Operation Desert Storm. Since then a new RAF version, the GR.Mk 1B, has entered service equipped with the TIALD imaging and laser pod.*

PHOTO FILE

SEPECAT JAGUAR GR.MK 1/GR.MK 1B

Jaguar carries a B-24's load ▶
This GR.Mk 1 carries eight 1,000-lb. bombs, equivalent to the tonnage carried by a WWII-era B-24 Liberator bomber. A more normal load includes chaff and flare pods, fuel tanks and a pair of infrared missiles.

Multi-role aircraft ▶
When originally delivered to the RAF, Jaguars were tasked with nuclear strike, reconnaissance and conventional attack. Only the latter role is performed today.

◀ The front office
This pilot's eye view of a single-seater's cockpit shows that it is fairly typical of a jet fighter-bomber of the 1970s.

▼ T.Mk 2 two-seater
The two-seat conversion trainer version of the GR.Mk 1 features a longer nose with the crew seated in tandem under separate canopies.

▲ Taking off from a highway
Demonstrating its ability to operate from dispersed sites, this Jaguar lifts off from a stretch of highway with a load of cluster bombs.

FACTS AND FIGURES

- During the Cold War there were up to 5 RAF "Jag" squadrons in Germany, the theoretical front line in a major conflict.
- A Jaguar was once accidentally shot down by an RAF Phantom in Germany.
- Jaguars in the Gulf were armed with iron bombs, cluster bombs and rockets.
- During Operation Desert Storm, 12 RAF Jaguars flew 618 sorties in January and February 1991.
- The RAF Jaguars' home base is RAF Coltishall, home to three squadrons.
- An RAF Jaguar once survived a high-speed wire strike at an altitude of just 30 feet.

PROFILE

The RAF's feline mud-mover

Throwing a fast fighter-bomber through mountains, at night, without radar, alone and unaided by a navigator may seem a recipe for disaster—but that is what RAF Jaguar pilots do on a regular basis without batting an eye. They know that the Jaguar, with 20-plus years of service behind it, is a tried and tested weapon that won't let them down.

When it came to a real war situation in the Gulf in 1991, the Jaguar showed that it still has teeth and is able to fly missions as well as aircraft that are considerably younger.

A Franco/British project, the result of collaboration between the British Aircraft Corporation (now British Aerospace) and Dassault-Breguet, the SEPECAT Jaguar was first flown on September 8, 1968, as a single-seat attack aircraft with limited all-weather capability. It was intended to serve both the Armée de l'Air and the RAF; the French Jaguar A entered service first, in May 1972.

The RAF took delivery of its first GR.Mk 1 in May 1973. A well-equipped tactical strike-fighter, its equipment included an inertial navigation system, a head-up display and laser ranger. From 1983, navigation upgrades resulted in the GR.Mk 1A. Some were able to perform a secondary reconnaissance role. The GR.Mk 1B and two-seat T.Mk 2B was introduced in 1995 with the TIALD pod, which allows a Jaguar to deliver its own laser-guided weapons.

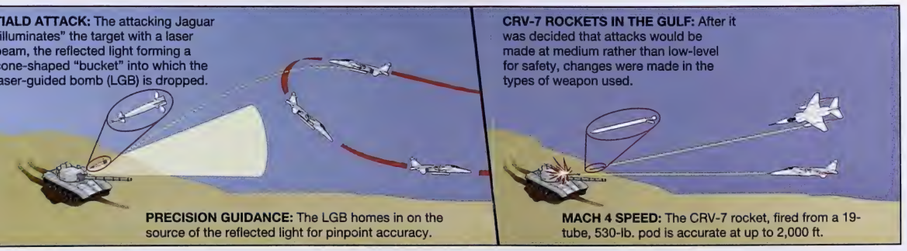
Jaguars are fitted with a retractable inflight-refueling probe, which greatly increases their range capability.

JAGUAR GR.MK 1A

XZ364 "Sadman" was one of a detachment of Jaguars from the RAF Coltishall Jaguar Wing based at Muharraq, Bahrain, and one of two RAF "Jags" that flew 47 missions in the Gulf.

Jaguar ground attack

IN THE GULF AND BEYOND: Typical ordnance loads during the Gulf War included general-purpose iron bombs, cluster bombs and rocket pods. Since then the RAF has equipped a number of single- and two-seat Jaguars with the TIALD (Thermal Imaging and Laser Designation) pod as used briefly by Tornados during Operation Desert Storm. This will allow Jaguars to deliver highly accurate laser-guided munitions autonomously, as well as "illuminate" targets for other aircraft.



SPECIFICATIONS
Jaguar GR.Mk 1A

Type: Single-seat attack bomber.

Powerplant: Two 8,000-lb.-thrust Rolls-Royce/Turbomeca Adour Mk 104 afterburning turbofans.

Maximum speed: 1,050 m.p.h. (Mach 1.5) at altitude.

Combat radius: 530 mi. on internal fuel.

Service ceiling: 45,986 ft.

Weights: Empty 15,400 lb.; max takeoff 33,972 lb.

Weapons: Two 30-mm Aden cannon plus provision for two AIM-9L Sidewinder air-to-air missiles on overwing pylons plus up to 9,975 lbs. of underwing stores on five pylons.

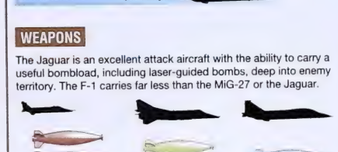
Dimensions:

Span	28 ft.
Length	57 ft.
Height	16 ft.
Wing area	260 sq. ft.

ACTION DATA

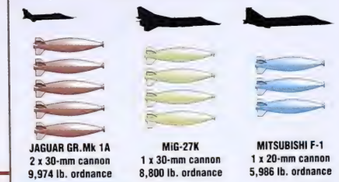
SPEED

For ground-attack aircraft, speed at ground-level is far more important than absolute maximum speed. All three aircraft have similar performance at lower levels.



WEAPONS

The Jaguar is an excellent attack aircraft with the ability to carry a useful bombload, including laser-guided bombs, deep into enemy territory. The F-1 carries far less than the MiG-27 or the Jaguar.



JAGUAR GR.Mk 1A
2 x 30-mm cannon
9,974 lb. ordnance

MiG-27K
1 x 30-mm cannon
8,800 lb. ordnance

MITSUBISHI F-1
1 x 20-mm cannon
5,986 lb. ordnance

COMBAT RADIUS

With a typical bomb load, the Jaguar can strike deeper into enemy territory than the MiG-27 or the Mitsubishi F-1. This capability was shown to good effect in the Gulf War of 1991 when RAF and French Jaguars attacked targets deep inside Iraq.

LOCKHEED

SR-71 BLACKBIRD

NUMBER 8 GROUP 1

RECORD BREAKERS

● High-flying reconnaissance ● World's fastest jet

The Lockheed SR-71 Blackbird is the most spectacular performer ever to leave the ground under its own power and spread wings. Thirty years after entering service, the Blackbird is aloft again after a premature retirement. It is still the world's fastest and highest-flying operational aircraft.

▲ *SR-71s operate at the extreme edge of the Earth's atmosphere, and their crews need to wear space suits to have a chance of surviving in the event of an emergency.*

PHOTO FILE

LOCKHEED SR-71 BLACKBIRD

◀ Stealth pioneer
The SR-71's shape is one of the first examples of the use of stealth technology to reduce the radar cross-section of a combat aircraft.

Hypersonic fighter ▲
The original CIA spyplane was developed into an armed interceptor. The YF-12 was equipped with radar and missiles carried in an internal bay.

▲ "Skunk Works"
This unique reconnaissance ship came from Lockheed's top-secret "Skunk Works," the developers of other high-performance aircraft such as the U-2 (below).

▲ Spy in the sky
In the SR-71's heyday, a pilot could set off from one of its three main bases and get a photograph of any part of the earth's surface within six hours.

Unique power and fuel ▶
The SR-71's engines run on JP7, a special low-volatility fuel. A fleet of specifically modified KC-135Q tankers keep the Blackbird in the air.

FACTS AND FIGURES

- The Blackbird crossed the United States at a record speed of 2,124 m.p.h. in 1990.
- Blackbird missions over North Vietnam were the fastest ever flown in combat.
- The pressure suits worn by the crew are identical to those used by astronauts on space shuttle missions.
- One version of this spyplane carried the D-21 reconnaissance drone, launched in flight at supersonic speeds.
- At high speed and altitude, friction causes the metal skin of the SR-71 to heat up to 400° Fahrenheit.
- Of 32 SR-71s built, three are flying today.

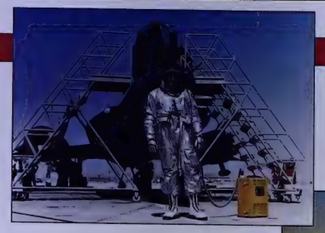
PROFILE

Eye in the sky

When it first flew in the 1960s, the black, needle-nosed SR-71 was an amazing performer. Three decades later, the Blackbird's capability continues to be unmatched, and the superfast jet has been pulled out of early retirement to resume reconnaissance flights. A pilot who watched this speedster return to flying condition called it a "magic machine."

But the Blackbird is more than an incredibly spectacular flier. Using cameras and electronic sensors, the SR-71 can look down from above or peer sideways hundreds of miles into enemy territory with a clarity that no other reconnaissance aircraft can equal. Before the Cold War ended, the SR-71 flew in support of the NATO allies, usually staying on its side of the border while spying on the other side.

The SR-71 has very powerful engines and uses special fuel, requiring its own tankers for long missions. Though space satellites have taken over many aerial eavesdropping duties, this "eye in the sky" with pilot and observer on board will continue to be used sparingly, like the treasure it is, when a crisis erupts somewhere around the globe.



Above: It took a lot of effort to keep the SR-71 and its space-suited pilots in the air. One estimate has put the cost of flying the Blackbird at more than $200,000 per hour.

Below: For many years the U.S. Air Force would say only that the Blackbird cruised "above 80,000 feet." It is now known that the jet can fly at at least 100,000 feet without any difficulty and can probably zoom even higher.

SPECIFICATIONS
SR-71A

Type: Two-seat all-weather strategic reconnaissance aircraft with electronic, optical, infrared or radar sensors.

Powerplant: Two Pratt & Whitney J58 turbo-ramjets each delivering 32,500 lb.-thrust with afterburners.

Maximum speed: Estimated at Mach 3.5 or more than 2,500 m.p.h.; normal operating speed over Mach 3 or 2,000 m.p.h.

Range: More than 2,500 mi. without refueling; intercontinental with aerial refueling.

Operational ceiling: 85,000 ft.; max ceiling estimated to be 101,500 ft.

Weights: Empty 60,000 lb.; loaded 170,000 lb.

Dimensions:

Span	55 ft. 7 in.
Length	107 ft. 5 in.
Height	18 ft. 6 in.
Wing area	1,800 sq. ft.

SR-71A

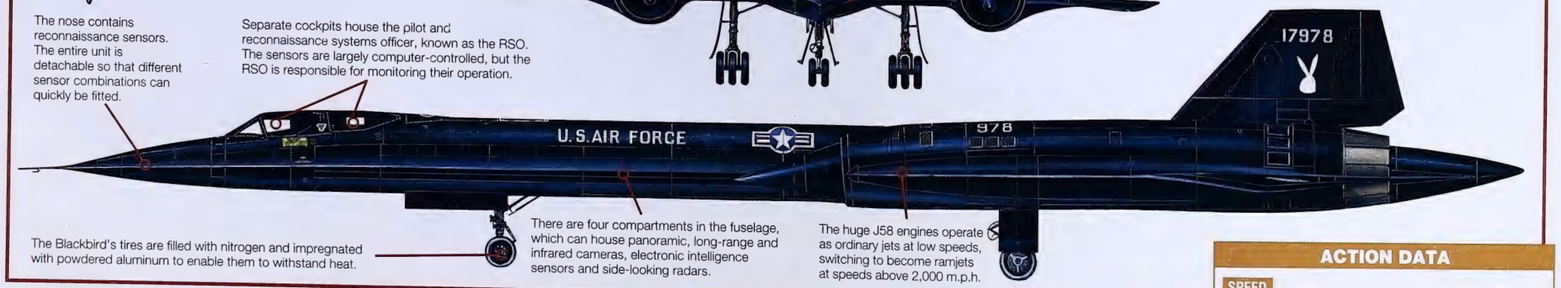
The 9th Strategic Reconnaissance Wing of the United States Air Force is housed at Beale Air Force Base, California, with detachments to Kadena on Okinawa and RAF Mildenhall in England.

The black paint is highly sophisticated and specially formulated to radiate excess heat while at the same time disrupting incoming radar energy. At operating temperatures and altitudes, it changes color to blue.

To withstand the intense friction-generated heat at Mach 3, over 90 percent of the Blackbird's airframe is made of titanium.

The vertical tails are the only large, flat surfaces on the Blackbird. They are canted slightly inboard in an attempt to deflect the large radar returns they would produce.

The component parts of the Blackbird fit very loosely to allow for expansion at high temperatures. At rest on the ground fuel leaks out constantly, since the six large tanks in the fuselage and wings only seal at operating temperatures. There is little danger of fire, however, since the fuel is very stable with an extremely high flash point.



The nose contains reconnaissance sensors. The entire unit is detachable so that different sensor combinations can quickly be fitted.

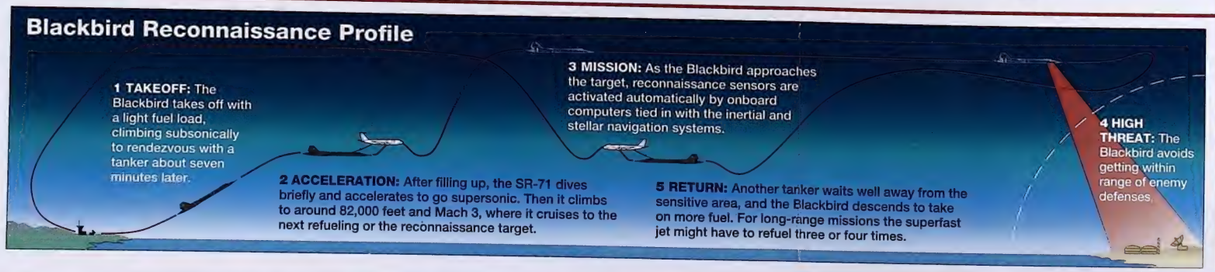
Separate cockpits house the pilot and reconnaissance systems officer, known as the RSO. The sensors are largely computer-controlled, but the RSO is responsible for monitoring their operation.

The Blackbird's tires are filled with nitrogen and impregnated with powdered aluminum to enable them to withstand heat.

There are four compartments in the fuselage, which can house panoramic, long-range and infrared cameras, electronic intelligence sensors and side-looking radars.

The huge J58 engines operate as ordinary jets at low speeds, switching to become ramjets at speeds above 2,000 m.p.h.

Blackbird Reconnaissance Profile



ACTION DATA

SPEED

The only aircraft that even approaches the Blackbird's speed is the MiG-25, and it can only sustain Mach 3 for a few minutes, compared to the eight-hour supersonic missions regularly flown by the SR-71. The Anglo-French Concorde is the only other aircraft that can sustain supersonic flight for hours at a time.

LOCKHEED SR-71

Operational speed over 2,000 m.p.h.

MiG-25R "FOXBAT-B"

Maximum speed 1,800 m.p.h.

LOCKHEED U-2R

Maximum speed 430 m.p.h.

LOCKHEED MARTIN

F-16 FIGHTING FALCON

● Lightweight fighter ● Multimission capable ● "The Electric Jet"

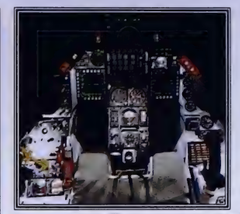
MODERN COMBAT AIRCRAFT

The F-16 Fighting Falcon is over 20 years old but still a star performer. Fast and potent, it remains one of the best fighters in its class. This relatively lightweight and inexpensive warplane gave us electronic flight controls and other high-tech wizardry. In addition, its radar, missiles and cannon make it a genuine Top Gun, respected by friend and foe alike.

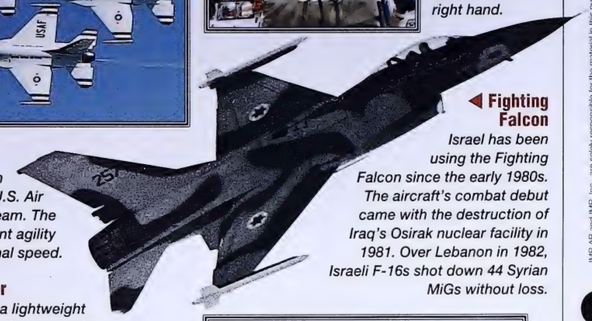
▲ *The F-16 pilot has at his command the West's premier light-fighter. The view from the cockpit is outstanding, thanks to the massive one-piece bubble canopy.*

PHOTO FILE

LOCKHEED F-16 FIGHTING FALCON



◀ Head-up fighting
The F-16 pilot reclines at 30 degrees and flies the fighter using a pressure-sensitive side-stick with his right hand.



◀ Fighting Falcon
Israel has been using the Fighting Falcon since the early 1980s. The aircraft's combat debut came with the destruction of Iraq's Osirak nuclear facility in 1981. Over Lebanon in 1982, Israeli F-16s shot down 44 Syrian MiGs without loss.

▲ Flying the flag
Perhaps the best known F-16s are those of the U.S. Air Force's Thunderbirds team. The F-16 gives them excellent agility matched with exceptional speed.

▼ Fighter and bomber
Originally conceived as a lightweight fighter, the F-16 emerged as a warplane capable of lifting just about every ground attack store available.

▲ Air defender
Falcons can launch the latest AMRAAM air-to-air missile. Using this weapon, a U.S. Air Force F-16 shot down a MiG-25 over Iraq.

FACTS AND FIGURES

- **Lockheed acquired General Dynamics, creator of the F-16, in March 1993.**
- **The company says it can build a new F-16 today for $20 million, less than half the price of an F-15E Strike Eagle.**
- **The F-16 ejection seat works safely at any speed and altitude.**
- **More than 4,000 F-16s serve in the U.S., NATO, Asia and Latin America.**
- **A delta-winged test version, the F-16XL, has wing area increased by 120 percent.**
- **F-16 pilots flew 13,500 combat sorties in Operation Desert Storm, more than any other aircraft.**

PROFILE

Lightweight superjet

The F-16 is proof that one aircraft can push back the boundaries of aviation. This marvelous warplane introduced features such as lightweight computers, "fly-by-wire" electronic controls and an arsenal of high-tech weapons.

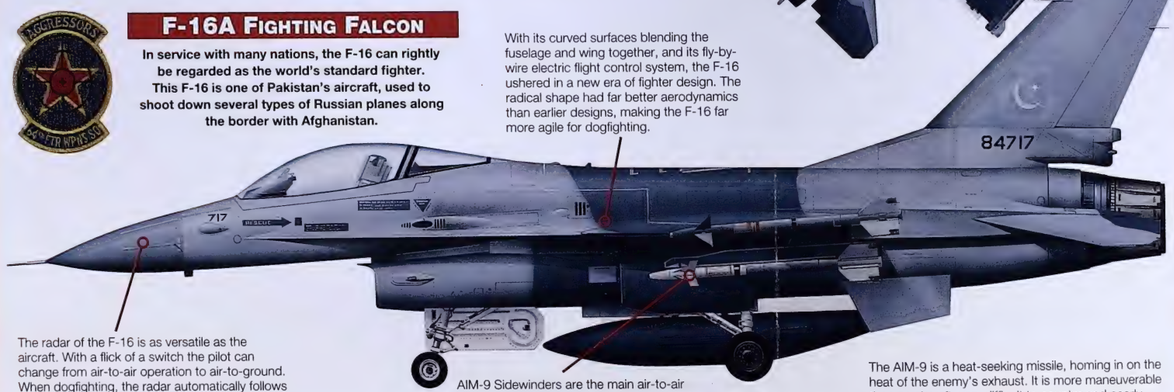
No longer new, the F-16 is still a boon to those who fly it. Pilots say the F-16 is a super ship, without equal from the viewpoint of the airman at the controls.

Engineers intended the F-16 as a no-frills "hot rod." It gained weight with the addition of improved radar and weaponry, but the F-16 is still smaller and more nimble than many fighters. Used mainly to drop bombs, the Fighting Falcon can turn and fight with unbridled fury when provoked. It also was one of the first operational fly-by-wire aircraft—its controls being electronically operated and computer controlled. The pilot sits in a seat that reclines at a 30-degree angle to withstand high-*g* maneuvers. In this position, he maintains a higher fighting ability than his enemy.

Despite its amazing agility, the F-16 is steady as a rock when it needs to be—diving in to attack a target with gun or missiles. Here a two-seater lets fly with a Maverick missile, a favorite against tanks.

F-16A Fighting Falcon

In service with many nations, the F-16 can rightly be regarded as the world's standard fighter. This F-16 is one of Pakistan's aircraft, used to shoot down several types of Russian planes along the border with Afghanistan.



Halfway along its back, the F-16 has a refueling receptacle so that it can take on fuel in flight. This feature is now standard on most military fighting planes.

Nearly all F-16s are painted light gray. This color was found to be the most difficult to see across a wide range of different weather conditions.

F-16s are powered by a Pratt & Whitney F100 engine. It is very powerful and very resistant to changes in airflow.

With its curved surfaces blending the fuselage and wing together, and its fly-by-wire electric flight control system, the F-16 ushered in a new era of fighter design. The radical shape had far better aerodynamics than earlier designs, making the F-16 far more agile for dogfighting.

The radar of the F-16 is as versatile as the aircraft. With a flick of a switch the pilot can change from air-to-air operation to air-to-ground. When dogfighting, the radar automatically follows the enemy and gives the pilot a steering cue on the large head-up display in front of him.

AIM-9 Sidewinders are the main air-to-air weapon of the F-16, seen here carried on the wingtips and on underwing pylons.

The AIM-9 is a heat-seeking missile, homing in on the heat of the enemy's exhaust. It is more maneuverable than an aircraft, very difficult to counter and nearly impossible to evade.

SPECIFICATIONS
F-16C Fighting Falcon

Type: Single-seat multirole fighter.

Powerplant: One 25,000-lb.-thrust P&W F100 or 25,200-lb.-thrust GE F110 afterburning turbojet.

Maximum speed: 1,320 m.p.h. (Mach 2.05) at 40,000 ft.

Combat radius: 800 mi. with drop tanks.

Service ceiling: 50,000 ft.

Weights: Empty 18,200 lb.; max takeoff 27,200 lb.

Weapons: One M61 Vulcan 20-mm cannon and up to 20,400 lb. of air-to-air and air-to-ground weaponry.

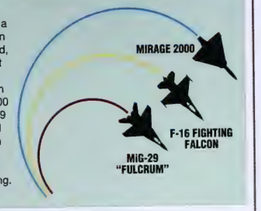
Dimensions:

Span	31 ft.
Length	47 ft. 8 in.
Height	16 ft. 5 in.
Wing area	278 sq. ft.

ACTION DATA

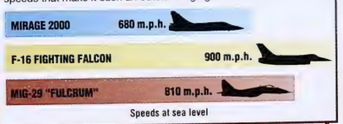
AGILITY

The F-16 was a revelation when it first appeared, being the most agile fighter in the world. Both the Mirage 2000 and the MiG-29 were designed to try to match the smaller American jet's superb handling.



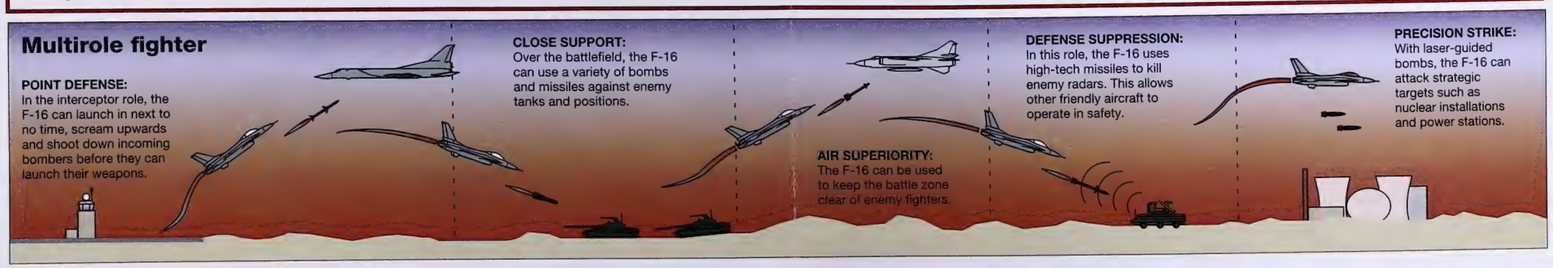
SPEED

Although capable of twice the speed of sound at altitude, it is the F-16's performance at lower level and its acceleration at lower speeds that make it such an outstanding fighter.



Speeds at sea level

Multirole fighter



POINT DEFENSE: In the interceptor role, the F-16 can launch in next to no time, scream upwards and shoot down incoming bombers before they can launch their weapons.

CLOSE SUPPORT: Over the battlefield, the F-16 can use a variety of bombs and missiles against enemy tanks and positions.

AIR SUPERIORITY: The F-16 can be used to keep the battle zone clear of enemy fighters.

DEFENSE SUPPRESSION: In this role, the F-16 uses high-tech missiles to kill enemy radars. This allows other friendly aircraft to operate in safety.

PRECISION STRIKE: With laser-guided bombs, the F-16 can attack strategic targets such as nuclear installations and power stations.

PANAVIA TORNADO GR.1

GULF WAR STRIKE

● Multirole strike fighter ● Dangerous low-level missions

NUMBER 9 GROUP

ADVENTURES IN FLIGHT

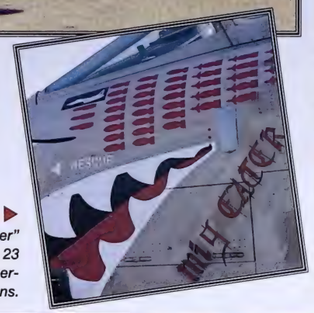
They flew the most dangerous air missions of the Gulf War. Hurtling through the night, less than 200 feet above the ground, their targets were the heavily defended runways of Iraq's military airfields. And the perilous nature of their role is reflected in the fact that the Royal Air Force's (RAF) Tornado GR.1s suffered proportionally the highest losses of all the aircraft taking part in Operation Desert Storm.

▲ *Tornados are designed to fly very fast, very low. Just how low is evident in this view from the cockpit of a Tornado as it races a hundred feet up through a desert "wadi."*

PHOTO FILE

PANAVIA TORNADO GR.1

▲ Low-level attack
JP233 dispenses two types of bomblets. The larger SG357 munition at the rear penetrates a runway before exploding, causing craters. The tiny HB876 mines dispensed from the front are lethal against repair personnel and vehicles.



On the deck
Control of this low-flying, exceedingly fast plane is largely automatic. The aircraft's terrain-following radar ensures that a constant ground clearance is maintained.

Multi-mission ▶
The nose of Tornado "MiG-Eater" records three JP233 missions, 23 bombing missions and 14 laser-guided bombing missions.

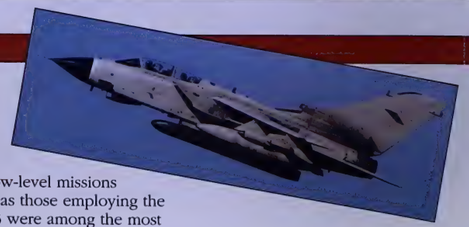
▼ Low-flying danger
Some crewmen, like Jon Peters (inset), managed to survive being shot down, getting out of their shattered Tornados only to suffer mistreatment at the hands of their captors.

▲ First mission
Strain shows on the faces of a returning Tornado crew after the first night's mission, along with relief at having survived unscathed.

FACTS AND FIGURES

- On the first three nights of the war Tornados flew 63 sorties, delivering JP233 runway attack munitions.
- Airfields hit included Al Asad, H-2, H-3, Shaibah, Tallil, Al Taqaddum and Ubaidah.
- Four Tornados were lost in the first five days, although only one carried JP233.
- Six RAF Tornados were lost in action, five crew members killed and seven captured.
- British Tornados flew a total of 1,600 bombing missions during the war, or 1.4 percent of the coalition total.
- Tornados delivered 100 JP233s, 4,250 free-fall bombs and 950 laser-guided bombs.

Gulf War spearhead



"It was a very, very black night; probably one of the darkest I have ever flown on. Over the desert, especially over Iraq, there are no lights. You are flying very low, and all you see is the odd Bedouin camp flashing by."

From the beginning of the Gulf War, British and Saudi air force Tornados made their trademark high-speed attacks. Passing low over their target, the huge JP233 containers beneath the fuselage dispensed runway-cratering munitions and area-denial mines, designed to prevent repair operations.

Low-level missions such as those employing the JP233 were among the most dangerous of the war. Five aircraft were lost to the full force of enemy antiaircraft artillery.

"It's absolutely terrifying. You're frightened of failure; you're frightened of dying. You're flying as low as you dare but not too low to drop your weapons. You put it over the target as low as possible, then you get away as fast as you can."

The problem was the size and multiple runways of the Iraqi air bases. It didn't take the Tornado pilots long to decide that destroying the taxiways leading to the runways was the most effective way of making the airfield unusable.

The lack of air opposition later in the war testified that the incredible courage of the crews was not wasted, and the Tornado force had done its job.

JP233 is no lightweight. Twenty feet long and weighing 5,150 pounds, it needs a powerful machine like the Tornado to carry its twin dispensers.

All of Tornado's wing stations were occupied by tanks or defense pods, with weapons carried under the fuselage. The only exceptions were two Sidewinders carried for self-defense.

Tornado's small swing-wing minimizes low-level, high-speed turbulence, so its two-man crew has a comfortable ride.

SPECIFICATIONS TORNADO GR.1

Type: Two-seat multirole combat aircraft.

Powerplant: Two Turbo-Union RB.199 Mk103 turbofans, each rated at 8,650 lb. dry and 16,100 lb. afterburning thrust.

Maximum speed: 920 m.p.h. at low level.

Combat radius: 870 mi. on a typical hi-lo-hi attack mission.

Service ceiling: More than 50,030 ft.

Weapons: Two 27-mm IWKA-Mauser cannons each with 180 rounds; 19,840 lb. of ordnance ranging from WE177B nuclear bomb, JP233 or MW-1 airfield attack weapons, Alarm or HARM anti-radar missiles, Paveway laser-guided bombs, and 1,200 lb. free-fall or retarded HE bombs.

Weights: Empty 30,620 lb; loaded 61,620 lb.

Dimensions:

Span	(28 ft. sweep)	45 ft. 7 in.
Length		54 ft. 9 in.
Height		19 ft. 6 in.
Wing area		286 sq. ft.

TORNADO GR.1 "MiG-EATER"

British air force Tornados in the Gulf were notable for their colorful nose art. "MiG-Eater," depicted here, was based at Tabuk. It was one of the most heavily used Tornados, being flown on 40 missions.

Tornado carries the Sky Shadow electronic countermeasures pod. This detects and jams enemy fire-control radars across a wide range of frequencies.

The Tornado's multi-mode radar is its primary navigation and attack system. Behind the radar is the chisel-like housing for the laser seeker, used when dropping precision-guided munitions.

After the Iraqi airfields were neutralized, Tornados switched to laser-guided attacks, using British 1,100-lb. bombs fitted with the Paveway II laser-guidance system. Two or three bombs were carried side by side on fuselage hardpoints.

The tip of Tornado's large vertical tail houses a VHF communications antenna. A pair of Marconi radar-warning receivers, which detect enemy search radars, project fore and aft immediately beneath.

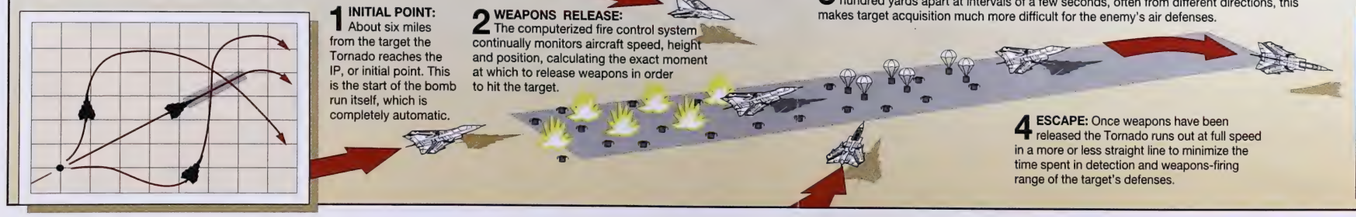
ACTION DATA

Iraq's air bases were the Tornado's primary target and were attacked with a number of different weapons. The two most effective required very different attack techniques.

JP233: Attacking with the specialized airfield denial weapon entailed approaching from as low as 250 feet, which made the fighter vulnerable to small arms and hand-held missiles.

LASER-GUIDED BOMBS: These were dropped with deadly accuracy from as high as 20,000 feet, as seen above, in almost complete safety from enemy defenses.

Tornado mission



1 INITIAL POINT: About six miles from the target the Tornado reaches the IP, or initial point. This is the start of the bomb run itself, which is completely automatic.

2 WEAPONS RELEASE: The computerized fire control system continually monitors aircraft speed, height and position, calculating the exact moment at which to release weapons in order to hit the target.

3 LAYDOWN ATTACK: Usually involving multiples of four aircraft attacking several hundred yards apart at intervals of a few seconds, often from different directions, this makes target acquisition much more difficult for the enemy's air defenses.

4 ESCAPE: Once weapons have been released the Tornado runs out at full speed in a more or less straight line to minimize the time spent in detection and weapons-firing range of the target's defenses.

The armament is designed to penetrate and crater the runway.

McDonnell Douglas F-4

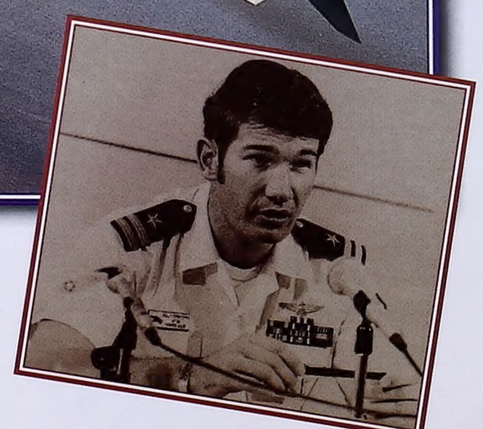
NUMBER 6 GROUP 7

ADVENTURES IN FLIGHT

Vietnam Phantom

● Vietnam warrior ● Fighter and bomber ● MiG-killer supreme

The Phantom broke all the rules. Fighters were supposed to be small, sleek single-seaters with guns. The Phantom was huge and had bent wings, a two-man crew and missile armament. It looked wrong, but it flew right. Strapped inside Phantom cockpits over Vietnam, naval aviators fought MiGs in raging air combat. Although there were some early problems, the Phantom came out on top almost every time.



▲ *Lt. Randy Cunningham and his RIO Lt. Willie Driscoll scored their third, fourth and fifth kills on May 10, 1972, to become the Navy's only aces of the war in Southeast Asia.*

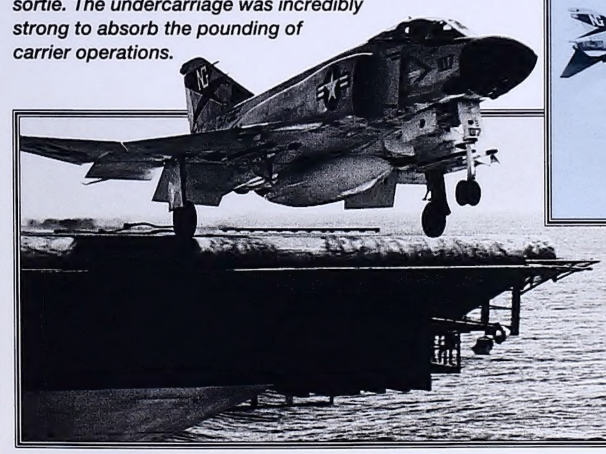
Photo File

McDonnell Douglas F-4 Phantom

▼ Top Guns of the 1960s
In the late 1960s the F-4 Phantom crew was considered the elite of the West's air forces. No service trained their crews better than the U.S. Navy.

▲ Marines at sea
It wasn't just the Navy that flew the Phantom from aircraft carriers. U.S. Marine Corps squadrons shared the load of shipboard deployments.

▼ Catapult launch
An F-4J thunders from the deck on an unarmed training sortie. The undercarriage was incredibly strong to absorb the pounding of carrier operations.



▲ Fighter-bomber
The Phantom was best known as a MiG-killer, but it did its fair share of ground attacking as well. These aircraft are seen over Vietnam, dropping 500-lb. bombs from the relative safety of medium altitude.

Facts and Figures

- ➤ Tests showed that pilots in Vietnam were more anxious about landing on the carrier than about fighting MiGs.
- ➤ Navy and Marine F-4B and F-4J fighters flew over 100,000 sorties in Vietnam.
- ➤ In early Vietnam combat, Phantom pilots were achieving only a 1:1 kill ratio.
- ➤ A Phantom weighs 4.68 times as much as the Hellcat fighter of 1944.
- ➤ After the introduction of "Top Gun" training, the kill ratio improved to as much as seven MiGs for each F-4 lost.
- ➤ On May 10, 1972, Navy F-4s from fighter squadron VF-96 downed six MiGs.

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PROFILE

U.S. Navy MiG-killers

Few human exploits compare with fighting in the F-4 Phantom. The big, powerful machine gave both pilot and radar officer the ride of their lives, blasting aloft with twice as much power as other fighters and going into battle armed to the teeth. Designed as a U.S. Navy carrier-based fighter, the Phantom became a jack-of-all-trades, doing many jobs so well that no other warplane met its standard.

With its far-reaching radar, the Phantom was meant to spot the enemy from a great distance and take him down with a radar-guided missile. It did not always work that way. A small, nimble fighter like the MiG-17 could pose a real danger to the Phantom if it got close enough.

The Phantom was both a fighter and a bomber, capable of unleashing up to 16,000 pounds of bombs. Further, if challenged in the air, the Phantom could fight back. Not surprisingly, the U.S. Navy's air aces in Vietnam flew the Phantom.

"Showtime 100" was the Phantom used by Randy Cunningham and Willie Driscoll on May 10, 1972, to score their three kills. The last was an epic battle against Colonel Tomb, reputedly the leading North Vietnamese ace. On the way home, "Showtime 100" took a SAM hit forcing the crew to bail out over the sea, but they were rescued safely.

Two crewmen meant an extra pair of eyes, which was a real advantage in a close-range, visual dogfight.

For air-to-air work, the Phantom carried four short-range heat-seeking Sidewinders on the wing pylons.

F-4J PHANTOM

By 1972, when Cunningham and Driscoll flew this aircraft to their three MiG victories, the F-4J was the standard shipboard fighter for the U.S. Navy. Because of its size, it could only fly from the larger carriers and could not fit on the small "Essex"-class ships.

In 1965, carrier fighter squadron VF-96 scored the Navy's first MiG kill of the Vietnam War. That was the unit's only success until 1972, when its crews downed a further eight MiGs, including five by the ace team of Cunningham and Driscoll.

For protection, the F-4 was fitted with a radar-homing and warning system that detected enemy-surveillance and fire-control radars. The antennas were housed in the tip of the fin.

The Phantom had a superb radar in the shape of the APG-59. This was the best in the world at the time and could track both low- and high-altitude targets.

To launch, the F-4 was hooked to the catapult with a heavy cable bridle, which fell away when the aircraft left the deck.

To highlight the secondary attack role of the Phantom, this aircraft carries cluster bombs.

The jetpipes of the Phantom were angled down to give an extra punch for carrier takeoffs. The arrester hook for stopping the aircraft was between the two engines.

SPECIFICATIONS
F-4J Phantom

Type: Two-seat carrier-based multirole fighter.

Powerplant: Two 17,900-lb.-thrust General Electric J79-GE-10 turbojets with afterburners.

Max speed: Mach 2.25 or 1,500 m.p.h.

Ceiling: 62,000 ft.

Combat radius: 900 mi.

Weights: Empty 29,700 lb.; loaded 54,600 lb.

Weapons: Typically: four AIM-7 Sparrow radar missiles and four AIM-9 Sidewinder infrared missiles. Maximum: up to 3,000 lb. of bombs beneath fuselage and up to 16,000 lb. of bombs under the wings.

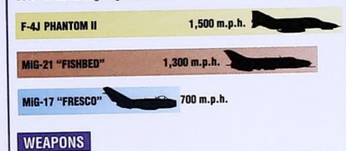
Dimensions:

Span	38 ft. 5 in.
Length	58 ft. 5 in.
Height	16 ft. 3 in.
Wing area	530 sq. ft.

ACTION DATA

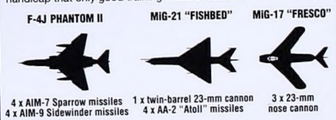
SPEED

The Phantom's sheer power gave it tremendous speed, but it was very much a straight-line machine. Although by no means a dogfighter, the F-4's climbing, diving and acceleration ability were used to advantage against slower but much more agile opponents.



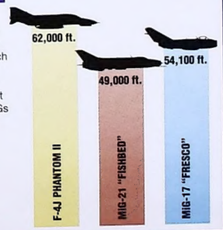
WEAPONS

American rules of engagement in Vietnam meant that F-4 pilots had to visually identify the enemy before firing, negating their long-range missiles. And in a dogfight, the lack of a gun was a severe handicap that only good training could overcome.



SERVICE CEILING

The combination of immense power and a large wing area meant that the F-4 could reach exceptionally high altitudes. Phantom pilots could usually get out of trouble with MiGs by outclimbing their less powerful opponents.



MiG-kills of May 10, 1972

THE NAVY TAKES ON THE MiGs: May 10,1972, was the Navy Phantom's big day over Vietnam. Flying from the USS *Constellation*, sister squadrons VF-92 "Silver Kings" and VF-96 "Fighting Falcons" blasted seven MiGs from the skies between them while a VF-51 crew shot down another for the Navy. To make matters worse for the North Vietnamese, Air Force Phantoms accounted for another three MiGs that day.

FIRST KILL OF THE DAY: Lt. Curt Dose (seen here demonstrating his dogfight) and Lt. James McDevitt from VF-92 scored the first kill of May 10, after blasting their F-4s down the Kep runway to stir up the MiGs.

TWO MiGs IN ONE DAY: RIO Lt. Thomas Blonski looks on as his pilot, Lt. Matt Connelly, relives one of their duels with MiGs on May 10. Two MiGs fell to their AIM-9 Sidewinders that fateful day.

THE FOE: North Vietnamese MiG-17s cower behind bunkers between missions. Although the faster MiG-21 was available, many experienced pilots, such as Colonel Tomb, favored the nimble "Fresco."

GRUMMAN

F-14A TOMCAT

● Long-range fleet interceptor ● Recon platform ● Fighter bomber

MODERN COMBAT AIRCRAFT

▲ *Tomcat aircrew are an elite within an elite. Pilot and backseat Naval Flight Officer act as a carefully coordinated team to wring the best from the awesome combination of performance, sophistication and firepower at their command.*

The F-14 Tomcat is the main defender of the U.S. fleet. With its high speed and ultra-long-range weapons, the F-14 can operate hundreds of miles away from its carrier base. The Tomcat AWG-9 radar can engage six targets at once and its Phoenix missiles can kill hostile bombers 90 miles away, before they can launch their attacks. The Tomcat is one of the world's true "Top Guns!"

PHOTO FILE

GRUMMAN F-14A TOMCAT

▲ **Fleet defender**
The main threat to U.S. Navy carriers is posed by long-range bombers armed with sea-skimming missiles. Only Tomcat can intercept the bombers before they get within lethal range.

▲ **Power to protect**
The F-14's high-thrust TF-30 turbofans and swing wing allow it to operate from short carrier decks. Takeoffs are made using a powerful steam catapult.

▼ **Detecting the enemy**
As well as its own radar, the F-14 operates with an E-2 Hawkeye, a flying radar station with a huge rotating antenna above the fuselage.

Deadly performer ▶
The F-14 has Mach 2+ performance, a sparkling rate of climb, good maneuverability—all the hallmarks of a great fighter.

▲ **Combat-proven**
The F-14 opened its score on August 19, 1981, when F-14 pilots Lt. Larry Muszynski (above) and Cdr. Hank Kleeman of VF41 "Black Aces" squadron destroyed a pair of marauding Libyan Sukhoi Su-22 "Fitters." Two MiG-23s fell to F-14s in a similar incident during 1989.

FACTS AND FIGURES

- The Tomcat's AWG-9 radar can detect, track and engage targets at ranges of more than 100 miles.
- One Tomcat can engage the same number of targets as three F/A-18 Hornets.
- The AIM-54C Phoenix is the world's longest-range air-to-air missile.
- The Tomcat's high magnification TV camera enables visual target identification at more than 30 miles.
- Forming the outer edge of a battle group's defenses, the Tomcat can engage enemy bombers and missiles more than 500 miles out from its home carrier.

PROFILE

Defender of the fleet

The F-14's swing wings allow it to combine high-speed performance and supersonic maneuverability with docile low-speed handling.

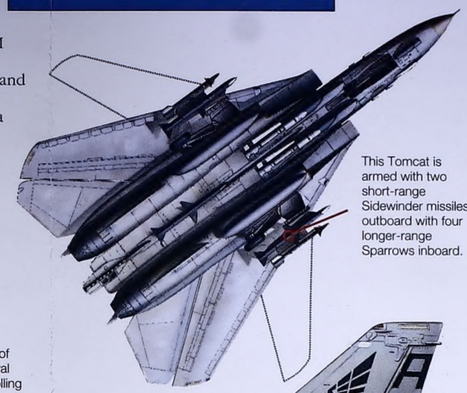
The Tomcat has been one of the great superfighters of the world since its first squadron took to the skies in 1972. It packs a massive punch, performs superbly and is the warplane of choice for many aspiring military pilots. Nothing is more likely to worry an enemy than to know Tomcats are on his track.

And yet this tremendous fighting machine can operate from a 350-foot strip of aircraft carrier deck, in all weather and around the clock.

Working with E-2C Hawkeye radar planes and using air-to-air refueling, a squadron of Tomcats can sanitize the airspace 400 miles out from the carrier battle group. This ensures that no hostile aircraft will threaten the warships below.

Even sea-skimming missiles can be killed by Tomcats using their Phoenix and AMRAAM missiles.

The fact is that Tomcats and their aircrews have to be good—they are protecting a 10-warship, $15-billion battle group manned by 10,000 sailors projecting as much firepower as the United Kingdom's entire armed forces.

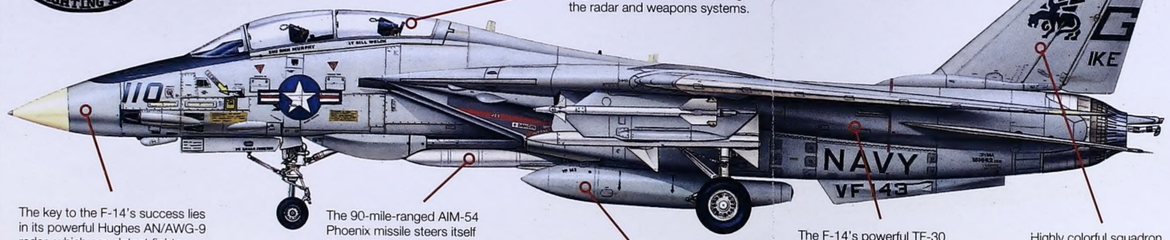


This Tomcat is armed with two short-range Sidewinder missiles outboard with four longer-range Sparrows inboard.

F-14A Tomcat "Pukin' Dogs"

An F-14A Tomcat of VF-143, an Atlantic Fleet fighter squadron nicknamed the "Pukin' Dogs." This world famous unit fought in Korea, Vietnam and the Gulf War, and has flown the Tomcat for 20 years.

The Tomcat carries a crew of two—pilot up front and Naval Flight Officer behind, controlling the radar and weapons systems.



The key to the F-14's success lies in its powerful Hughes AN/AWG-9 radar, which can detect fighter-sized targets at very long range, and even allows the F-14 to shoot down cruise missiles.

The 90-mile-ranged AIM-54 Phoenix missile steers itself toward the target using an onboard inertial navigation system, then homes in using its own onboard radar.

The Tomcat can extend its range or endurance by using in-flight refueling or by carrying external fuel tanks.

The F-14's powerful TF-30 turbofans give the aircraft superb performance and economy, but have proved troublesome and unreliable.

Highly colorful squadron markings have given way to a subdued low-visibility gray camouflage on all U.S. Navy aircraft.

SPECIFICATIONS
F-14A Tomcat

Type: Two-seat long-range shipboard fleet defense interceptor, tactical reconnaissance aircraft and fighter-bomber.

Powerplant: Two Pratt & Whitney TF-30-P-412As.

Max speed: 1,584 m.p.h. at 40,000 ft.

Combat radius: 378 mi. on internal fuel; 750 mi. with two 130-gal. tanks.

Service ceiling: 68,900 ft.

Weapons: One 20-mm Vulcan cannon. Six AIM-54 Phoenix missiles or six AIM-7 Sparrow plus four AIM-9 Sidewinder missiles. Up to 14,300 lb. of air-to-ground weapons.

Weight: Maximum takeoff 70,280 lb.

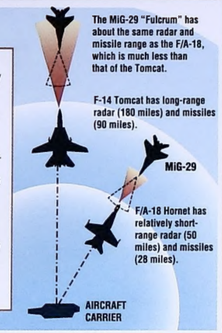
Dimensions:

Span	61 ft. 10 in.
Length	62 ft.
Height	16 ft.
Wing area	565 sq. ft.

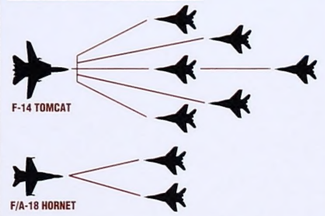
ACTION DATA

REACH

The Tomcat's fuel capacity and highly efficient turbofan engines allow it to operate further out from the carrier than its F/A-18 Hornet counterpart. Once at its patrol station, the Tomcat can see further and reach further with its Phoenix—destroying enemy fighters before they can launch their own missiles against the fleet or the Tomcat itself.



SIMULTANEOUS ENGAGEMENT



The F-14 can simultaneously engage up to six targets, flying at different altitudes, airspeeds and in different directions. Because the Phoenix missile has its own radar, it is independent after launch. The F/A-18 can fire only two Sparrows at a time, against targets which are close together. Unlike the Phoenix, the Sparrow requires the Hornet to continue flying toward the enemy using its radar, making it vulnerable to a return missile shot.

Weapons of the Tomcat

AIM-9 SIDEWINDER: The highly agile Sidewinder is used against maneuvering targets. It homes on heat—for example, from the enemy's jetpipes. **Range 5 miles.**

AIM-7 SPARROW: The Sparrow homes on radar energy reflected from the target, which must be illuminated by the F-14's radar for the whole of its flight. **Range 28 miles.**

AIM-54 PHOENIX: Weighing in at almost 1,000 lb., costing $2 million and with a range in excess of 90 miles, the AIM-54 is the world's biggest, most costly and longest-range air-to-air missile. Tomcat can launch six AIM-54s simultaneously against separate targets. The missile's onboard radar lets the F-14 turn away after launch. **Range 90 miles.**

BOMBCAT: The Tomcat can carry a range of dumb (unguided) bombs for use against ground targets. Tomcat squadrons began training in the bombing role in 1991.